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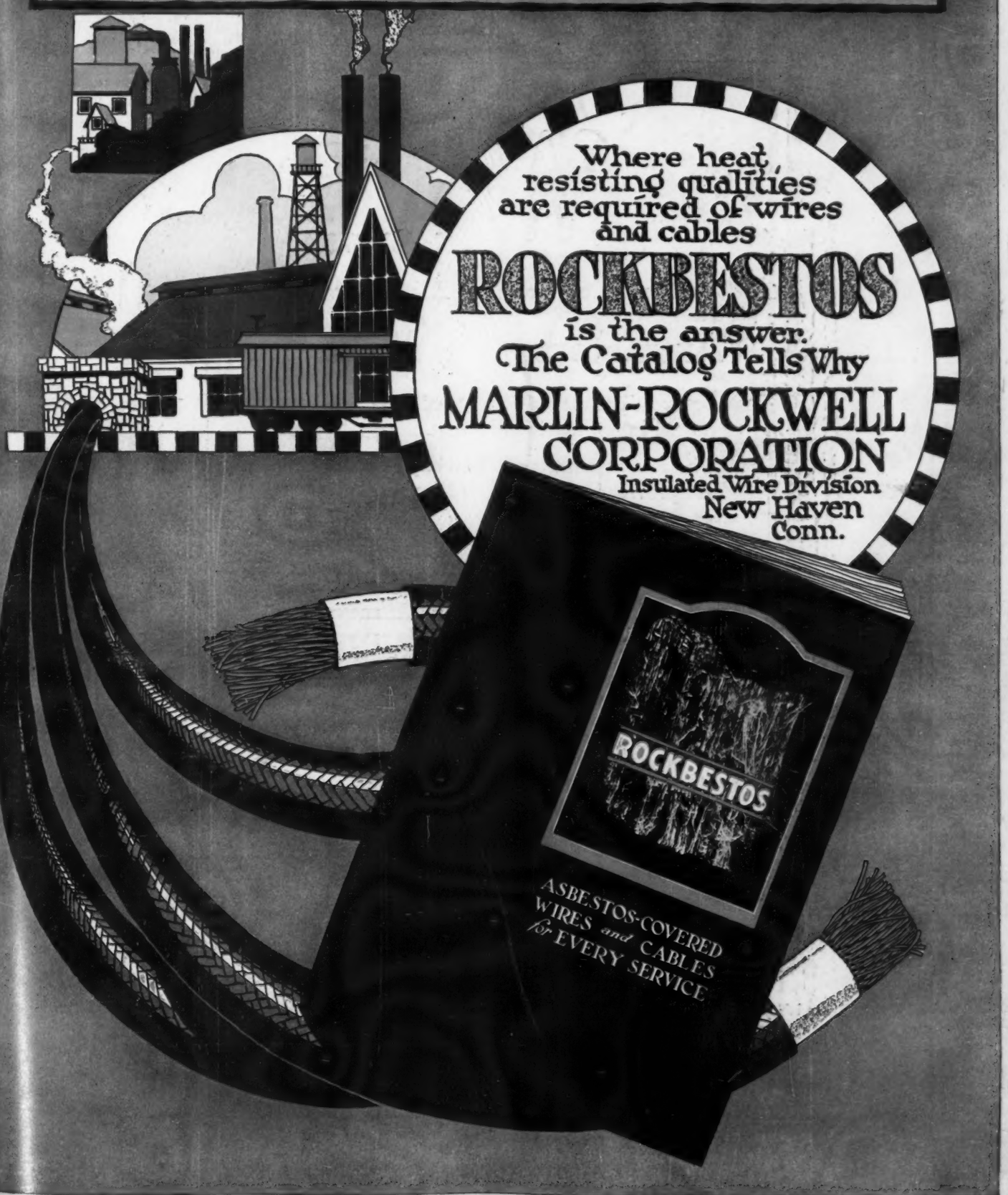

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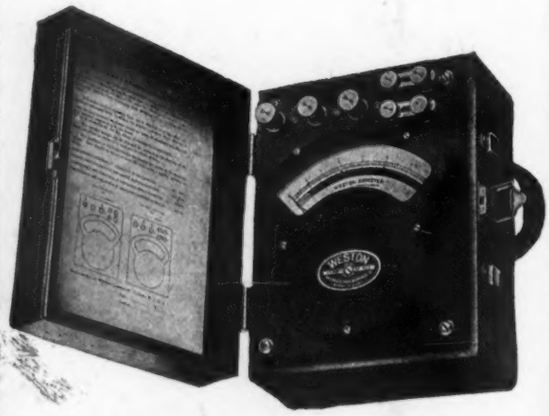

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Volume 76 New York, Saturday, August 28, 1920 *Number 9*

The Electrical Home Idea

THE stimulation which has been given the use of labor-saving household appliances by the "electrical home" idea, now rapidly spreading in the West, means much more to the industry than the kilowatt-hours used or the sale of the millions of dollars' worth of equipment. It means that the dwellers in these homes will have a deeper appreciation of the fundamental necessity of electricity if properly directed and encouraged by the electrical industry. These people will be builders of public opinion most favorable to the better regulation and easier financing of electrical developments. The thing to do is to sell the electrical idea with the electrical home idea.

Cost and Competition for Money

PUBLIC utility financing in years gone by called for the best thinking of the executive and operator in management and operation. Today nothing short of ingenuity and persistence, based upon the results of the foresight originally displayed in building for the future, is keeping the business on a going basis. To the increases in costs of operation and construction have been added difficulties in getting money for needed expansion in the form of competition from Canadian securities and those of foreign governments with a rate of return better than 8 per cent, as well as from the securities of industries in which the risk is sufficiently small to destroy interest in public utility paper that returns less than 8 per cent. To commissions the utilities are looking for a remedy through the granting of such increases in rates for service as will enable them to compete for money on a fair basis. This relief, already postponed too long, should come with little delay on the presentation of the required evidence, for when the process of deflation has been completed and the wreckage cleared away the assured stability of public utility investments will be evident.

A Queer Municipal Point of View

VIGOROUS protests have arisen in the city of Sheffield, England, over the action of the municipal authorities in adopting a flat rate for electrical energy regardless of its use. The city government holds that the cost of generating every kilowatt-hour is the same at any given moment, that it is no concern of the city to what use it is to be put, and that all must pay alike except for uniform concessions on a sliding scale to large consumers. The manufacturers naturally cannot see either policy or justice in thus wiping out the distinction between motor service and lighting service, and they maintain that if the flat-rate charge is enforced the effect on the rapidly spreading electrification of mills and factories will be disastrous. It would seem at this distance as if the officials of the British city are little likely to increase the popularity of municipal ownership by flying in the face of expert knowledge and accumulated experience.

Cut Glare and Save Energy

GLARE will probably, like the poor, be always with us, but the wise user of electric illumination will never relax his efforts to reduce this disturbing and wasteful characteristic. Misdirected light is generally synonymous with excessive consumption of electrical energy. The demand for electric service is growing fast and in many cases cannot be supplied as rapidly as is desired. There is a direct relation between giving a community better and larger service and campaigning against careless and spendthrift uses of plant output. Even if bills are reduced in individual cases by the cutting down of glare and the correct distribution of luminous flux, little likelihood exists of permanent loss of revenue. New uses of electricity in old establishments diversify the load, tend to increase plant efficiency and spread patronage, all to the betterment of the investment.

Aëroplanes in Hydro-Electric Construction

SUBSTITUTION of the aëroplane for the automobile in inspection work by the construction engineer of the San Joaquin Light & Power Corporation marks the entry of this mode of transportation into hydro-electric construction in the West. Other uses may be expected to follow, for the plans of the Southern California Edison Company for its new plants in the High Sierras include the employment of bombing planes to transport construction materials. Where the projects are situated great distances from engineering headquarters, with the country rough and mountainous and the trails narrow and precipitous, the aëroplane enables a start to be made on construction work several months earlier than would be possible by building the necessary roads. Other obvious uses of the aëroplane include the spotting of men and material in inaccessible places, the patrolling of long transmission lines and the locating of special trouble arising from storms or floods.

Segregate Industrial Loads

UNLESS active steps are taken by many central-station companies to reclassify their connected industrial loads, serious errors are sure to creep into unit cost and revenue analyses of the power business. On numerous systems the motor load so far overbalances the heating output that at present no great harm is suffered in figuring yearly revenues per horsepower connected, average energy sales per horsepower installed, new-business expenses, installation outlays and other items of interest in the scientific management of central-station operations. In other cases, however, electric

furnaces, welding outfits, ovens, large cooking installations and diversified apparatus of growing importance are absorbing so much energy and yielding so much desirable income that a proper analysis of the results of such business demands a separation for statistical purposes of this class of load from motor service. State commissions should modify their annual return forms to provide for this separation of data, and operating companies on whose systems the industrial heating load is important can well afford to establish and to maintain the necessary equipment and the corresponding performance records.

The Complete Automaton

STATIONS substantially automatic have been described from time to time, and we now are pleased to greet what seems to be quite the nearest approach to a reasoning mechanism that has yet been devised. The mechanism in point, described in this issue by S. G. Leonard, is that of several automatic industrial substations for the big plant of the Packard Motor Company at Detroit. The plant had quite outgrown the economic range of its own direct-current system, so the situation was met by taking three-phase energy at 4,600 volts from the central station and setting up at strategic points along the direct-current bus system automatic motor-generated substations each of 1,500 kw. capacity. The sensational feature of the installation is not, however, in the unusual size of the automatic units but in the application of automatic working to synchronous motor drive, obviously of great importance in a case like this.

The substation starts, if the direct-current bus voltage is abnormally low for five seconds, by energizing the motor through an auto-transformer, bringing it up to synchronism and then transferring it to the running connection. Then the direct-current generator, having been brought close to the bus voltage, is thrown in and the voltage is adjusted to 250, where it is held up to 125 per cent of full load, above which point the voltage is automatically lowered until the load is at that limit. Below this point the control is shifted to voltage regulation for 250 volts unless the load drops below 15 per cent for a predetermined period, when the motor-generator automatically retires from service until again needed. Besides all this there are the usual relays against overload or reverse current on either side, plus protection against overheating of the machines or their bearings and overspeed.

One must read in detail the various items of this extraordinary system of automatism fully to appreciate it, but its most remarkable feature is the bringing of the big motor into synchronism and full action. This is accomplished by taking advantage in a highly ingenious fashion of the sudden drop of the alternating starting current as the motor falls into synchronism and the simultaneous building up of the exciting current derived from the direct-current machine. The co-operative character of these changes is fully shown in the diagram of connections. The situation calling for such an elaboration of automatic devices is a rather exceptional one, but it has been met by a most remarkable display of resourcefulness, and we shall be surprised if the final result is not an admirable one. Although minor difficulties may develop and require symptomatic treatment, the installation represents a long step ahead toward that full self-control that will go far to promote the interconnection of groups of auxiliary electric plants.

Arcing Grounds on High-Tension Lines

IN THE modern electrical engineering laboratory a number of arc oscillators have come into use for the purpose of generating a sustained series of electrical oscillations, usually of high frequency. The electrical oscillations so produced are ordinarily utilized either for heating or for electric communication. Although these arc oscillators differ in many ways among themselves, yet they all have the characteristic habit of producing an oscillatory discharge in a conducting path, thereby lowering the potential at the arc. The arc is then weakened. The potential thereat rises to a point where the discharge becomes reinforced, and so on in indefinite cyclic repetition. It sometimes happens by mischance that conditions at some weak point on a transmission line lead to an arc discharge which is able to establish recurrence automatically. Each such discharge may set up a series of powerful transient surges along the line. Under these circumstances a persistent generator of oscillations may be formed. If the discharge to ground is powerful, so that many amperes pass through the arc, the rupture of the discharge may set up enormous transient voltages. The most objectionable feature of the combination is that it tends to be persistent, so that the insulators and insulating system are subjected to prolonged overstress.

In an article on the subject this week by W. D. A. Peaslee a special form of artificial transmission line is described, together with the measurements made of an artificial arcing ground's characteristics. The quantitative relations involved are by no means easy. Many measurements of this kind, under various and regulated conditions, will be necessary before a satisfactory theory of the phenomenon is likely to be obtained. It is, however, comforting to see a beginning made in the quantitative investigation, and the method described should prove helpful to other researchers.

Electric Vehicles in City Service

IN THE Digest section of the ELECTRICAL WORLD recently reference was made to a study of the electric vehicle situation which deserves more than a passing thought. The problems concerned are substantially alike the world over, and here, as abroad, the really vital one is the provision of adequate charging facilities. The most vigorous drive to promote the use of electric vehicles is doomed to failure if there is constant trouble with prompt and proper charging. The special field most usefully covered is commercial and convenience traffic in urban and suburban territory. As to the first, the very general adoption of the eight-hour day makes horse-drawn trucks particularly uneconomical, and the rising cost of gasoline seriously affects the ordinary power truck even now, with worse conditions in prospect. There are, too, other adverse conditions in its use which cannot be neglected. Any one who takes notice of the actual operation of the ordinary delivery car observes that the engine is seldom stopped for a delivery of goods but is kept running while a boy scatters an armful of packages at several neighboring

houses. A short run and the performance is repeated, and so on for hours.

For the purposes of vehicles designed to run around over a moderate area, electric drive is uniquely simple and convenient. For either light or heavy service electric trucks can now be had at a reasonable price, and the batteries have been improved until, when properly cared for, their endurance is admirable. Right here comes the rub—insuring that necessary care. We see no other way than the provision of service stations in sufficient number and capacity to give the electric vehicle owner a fairly easy time of it. It is futile to answer that once there are a multitude of electric cars in use service stations will naturally spring up—for you cannot get the multitude without them.

Lack of convenient charging facilities is the main reason that the electric vehicle, with all its manifest advantages, lags behind its opportunities. The advent of cheaper, lighter and more efficient forms of electric vehicles is only a step in the right direction, for the real trouble lies in the small mileage of motive power carried, combined with lack of facilities for supply and lack of care. To insure care requires the active cooperation of manufacturer and central station. The field is so good for both and the progress made of late so real, even on a modest scale, that it is high time to push on. But no amount of boosting will do real and permanent good if the charging facilities remain lacking.

Industrial Power in California

CALIFORNIA is the banner state in the development of electric service. It furnished the cradle of modern power transmission and has assiduously nourished it into full growth. No other state shows so general a distribution of power supply or so large a proportion of its people availing themselves of it. One does not wonder, then, that in industrial work California shows the leadership that is indicated in the preliminary survey published in this week's issue. No data of this sort can be made absolutely complete, but they do in this instance give a correct indication of the situation as it is. Broadly, they show that more than five-sixths of the rated horsepower of the motors in the 300 large industrial works on which reports have been received is operated on purchased energy. Less than 5 per cent of the power comes from isolated plants and most of this in cases where the fuel is a byproduct. The causes of so remarkable a result are clear. In the first place, the state is pretty much a continuous network of transmission and distribution lines from which power can be obtained at a moderate price. The use of this power has been intelligently exploited, and recent conditions in industry have tended to make motor drive imperative.

Such conditions are really dominant, for the high cost and relative inefficiency of labor call for the utmost that can be done in efficient labor-saving devices. Experience has very plainly shown that motor drive is the foundation upon which such achievements are built. The list which we publish indicates the varied nature of the industries for which these conditions hold, and that, despite California's great supply of fuel oil, transmitted power holds the field. Our readers will do well to study these data from the Pacific Coast with particular reference to the situations elsewhere. Of course, the hydro-electric resources of the East are less extensive, and until recently fuel has been relatively cheap. That advantage is disappearing and it cannot come back. Everything indicates that fuel, and particularly the transportation factor in its price, will remain high. The obvious inference is that industry must more and more rely on hydro-electric power or power generated by fuel at the highest possible efficiency. The big central stations have risen to the occasion and are extending their lines, yet they are chiefly of urban utility, and it is to the extension of industry over the whole country that we must look for ultimate and permanent prosperity. Therefore, there cannot too quickly be the fullest possible extension of the supply of electric power, following the good example set by California. The nation's biggest problem today is the distribution of industry, not its concentration.

Establishing a Simple Basis for Rates

THE incursions which public demands for power have in recent time been making upon the maximum supply which central stations are able to deliver has made it necessary to scan more closely the plants and factories which operate at low power factors. Such customers' plants not only take a reduced amount of active power from the volts and amperes they absorb from the mains, but they also prevent other customers from receiving their due share of power when the central-station generators are working up to their volt-ampere capacities.

The consensus of opinion at the White Sulphur Springs convention of the American Institute of Electrical Engineers last June was that the power factor of any polyphase system, balanced or unbalanced, should be defined as the ratio of the total active to the total apparent power, and is obtained from the ratio of the total active and the total reactive components, as recorded by polyphase active wattmeter and polyphase reactive wattmeter respectively. It was held that the unbalance factor should be separately defined and taken into account in the contracts.

Last week we printed a paper by Ray H. Wolford, on a plan for establishing rates based on a different scheme of measurements. It is proposed to measure the total active energy consumed, by means of a polyphase watt-hour meter, to the usual degree of precision, in the usual way, and also to install a special instrument consisting of a three-phase, four-wire, three-current-coil polyphase watt-hour meter so modified, adjusted and connected as to record total voltampere-hours, or total apparent energy consumed, with a more limited degree of precision. By the use of an ordinary block-interval demand meter, controlled through the usual contact-making devices, it is proposed to secure a maximum-demand record in kilovolt-amperes, that is to say in apparent power.

The plan of operating a watt-hour meter in such a manner as to record apparent energy on its dial is ingenious, but necessarily limited in precision, except when the power factor is constant. It is claimed, however, that the power factor may vary over a considerable range without introducing a large error in the record, and that the degree of precision secured is commercially sufficient for ascertaining the maximum demand. This is an interesting subject for discussion among central-station managers.

W. Winans Freeman

A public utility executive whose ideas and ideals of electric service have been widely reflected in the policies and practices of the industry

FOR the past ten years W. W. Freeman has been an influential counselor on matters of public policy in the National Electric Light Association. For 1910 and from 1914 to 1919 he was chairman of its committee dealing with these matters. This recognition has been accorded to him largely on three counts: He came up through the ranks of a large central-station organization; he has studied from all angles the components of good service and the ways by which an understanding of good service will capture the good will of the public, and he conceived in the beginning the value of commission regulation and has untiringly fought for a fair consideration of the service functions of the utility and the needs of the public. Mr. Freeman's rise in public utility affairs has been due to clear thinking and honest, ambitious effort. He was born in Canada June 8, 1872, and received his education in that country, but came to the United States at the age of seventeen. He was first employed as a stenographer in the office of the Edison Electric Illuminating Company of Brooklyn, but was advanced rapidly to be secretary to the general manager, assistant secretary of the company, then to be secretary and treasurer, and finally to be the active head of that organization with the title of vice-president and general manager. In 1913 he resigned to become American representative of the English financial house of Sperling & Co., which had large investments in public utilities in the United States, Canada and Mexico. In 1914 he became associated with the Columbia Gas & Electric Company as vice-president, assuming executive direction of that company's properties in Ohio and Kentucky, with headquarters in Cincinnati. In that city he is president of the Union Gas & Electric Company, one of the above-mentioned properties.

Mr. Freeman has served as president of the National Electric Light Association and of the Association of Edison Illuminating Companies. Last year he was elected president of the Society for Electrical Development in recognition of this knowledge of conditions in the electrical industry and his ability to assist in working out the comprehensive program of promotional work which that society has been engaged in since the close of the war. His success in this undertaking is evidence both of his whole-hearted, unselfish devotion to the electrical industry and the thoroughness with which he does things.

First Automatic Industrial Substation

Motor-Generator Set of 1,500 Kw. Is Installed at Load Center and Automatically Takes Load When Voltage Drops — Automatic Features Will Reduce Operation Cost, Give Improved Service and Reduce Light Load Losses

By S. G. LEONARD

Switchboard Engineering Department Westinghouse Electric & Manufacturing Company

THE present trend in industrial plants to spread over considerable ground area has brought forth several problems which are not present in smaller plants. Of these problems the supply of electrical energy for the motors and control apparatus in the shop has met with some difficulties, especially when direct-current energy is used. When it is planned to utilize the energy at some distance from the power plant a large investment in copper for buses is necessitated and poor voltage regulation may result. An obvious remedy is to change to alternating-current supply and to convert this to direct-current energy at the load.

The Packard Motor Company of Detroit encountered this trouble in supplying a heavy load from direct-current generators. The peak load on this plant is 24,000 amp., and it is expected that it will increase to 30,000 amp., in the near future. The power station is near the center of the factory, and the distribution requires a heavy bus run in a tunnel the full length of the buildings. The voltage drop at the end of the bus is considerable, and the I^2R loss consequently is large. To improve the voltage regulation and to provide for the increasing demand it has been decided to purchase alternating-current energy from the central station and to install a number of substations along the plant bus, at points as near the large load centers as possible. This will permit the removal of some of the present copper. These substations are to be made full automatic, in order to obtain further economy, and there is now building the full automatic control equipment for two of these substations. Each is to control one motor-generator set with a 4,600-volt, three-phase, 60-cycle synchronous motor and a 1,500-kw., 250-volt, two-wire direct-current generator. The field of the synchronous motor is to be excited from the direct-current generator.

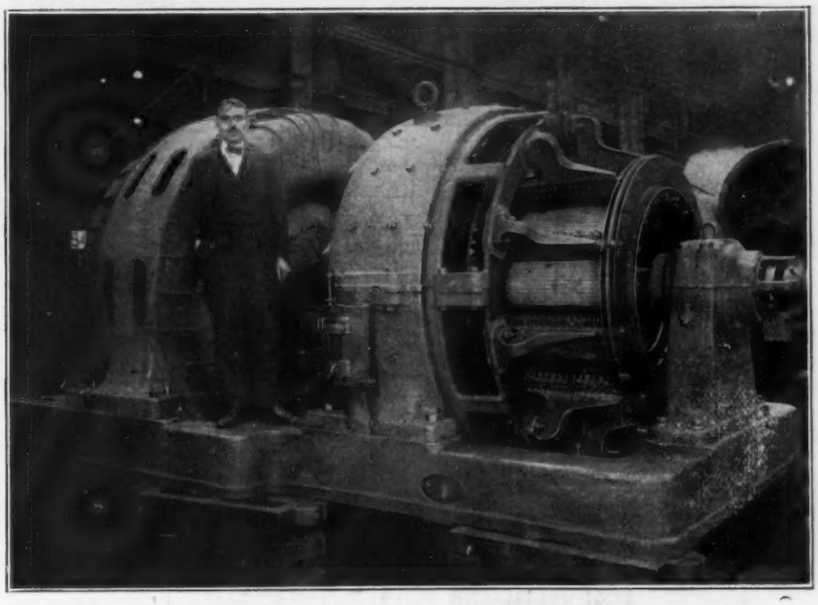


FIG. 1—1,500-KW. MOTOR-GENERATON SET FOR AUTOMATIC OPERATION IN PACKARD MOTOR PLANT

The control features of this station can be summarized as is indicated in the following paragraphs:

(a) The station starts if the direct-current bus voltage lowers and remains down for more than five seconds.

(b) The alternating-current motor is connected to the auto-transformer, brought up to speed and, when in synchronoism, transferred to the running position using a transition scheme of change-over.

(c) The direct-current generator voltage is automatically adjusted to within a small percentage of the bus voltage before the direct-current carbon breaker is closed.

(d) After the carbon breaker is closed the voltage is automatically adjusted to 250 volts and maintained at that point until the load on the generator has reached 125 per cent full load.

(e) If the concentration of load adjacent to the automatic station becomes so great that an overload is thrown on the machine, the voltage will be automatically lowered until 125 per cent full load is carried.

(f) Whenever the load falls so that there is less than 125 per cent full load on the machine, the control is restored to a voltage-regulating relay and the bus will be held at as near 250 volts as possible.

(g) If the machine carries less than 15 per cent of its rated load for a period of time accurately adjustable from three to twenty minutes, the station will be automatically taken out of service.

(h) Automatic protection is provided against alternating-current overload, alternating-current low voltage, alternating-current failure or phase reversal, direct-current reverse current, direct-current overload, overspeed, hot bearings and too high machine temperature.

(i) The operation of the entire equipment depends only on the sequence of operation of relays and contactors which function as a direct result of the electrical condition present at the time of operation.

By reference to Figs. 2 and 4 the sequence of operation may be traced as follows: When the voltage on

the shop bus falls below a predetermined value, for example 90 per cent of normal or below, the station is started. The contacts of the primary direct-current voltage relay (1) close and a circuit is established if the knife switch is closed, energizing the coil of alternating-current voltage time-delay relay (2). At the end of a definite time interval, which may be adjusted accurately up to a maximum time of five seconds, the contacts of this relay close. The time element prevents the station responding to momentary reductions in direct-current bus voltage, and in addition prevents the station from starting in case the alternating-current-voltage is abnormally low. The closed contacts of the alternating-current voltage relay (2) complete a circuit which closes a two-pole, 50-amp. master relay (3), thereby energizing the auxiliary control bus *A*-1. The relay completes its own holding circuit, making further functioning of the control apparatus independent of line voltage. Energizing of the auxiliary control bus *A*-1 energizes also control bus *A*-2 until after direct-current carbon breaker (12) closes. This is an 8,000-amp. carbon-type, electrically operated, non-automatic breaker connected between the positive side of generator and the positive shop or line bus. Its closing coil is operated from direct-current energy. Upon closing, the breaker latches in, and the voltage must be cut off from the closing coil. Shunt relays (4 and 6) similar to the two-pole master relay close and in turn close the alternating-current star point breaker (5) and the alternating-current starting breaker (7). These breakers are oil-immersed, three-pole, single-throw contactors which are closed by means of alternating-current magnets. The contacts are held closed by keeping voltage applied to the operating coil and are not mechanically latched. The first-mentioned breaker is used for connecting an end of each auto-transformer to a common point, thus forming a star point. The second breaker is used for connecting the synchronous motor leads to the starting taps of the auto-transformer. Both breakers have several mechanical interlocks. Thus this operation starts the motor-generator set.

As the set comes up to speed the starting current decreases until synchronism is reached, when it takes a sudden drop. The field of the synchronous motor, directly connected at all times to the armature of the direct-current generator for excitation, has an induced emf. generated in it which opposes the tendency of the generator to build up its voltage until the motor pulls into step, after which the generator builds up in the normal way, thus increasing the motor-field excitation to normal. Use is made of the combination of these two phenomena to indicate synchronism, as follows: A low-current induction-type indicating relay (9), the contacts of which open on over current, is connected to the secondary of a current transformer in the starting-tap circuit, and the coil of the field current relay (8) is connected in the motor-field circuit. While coming up to speed the large motor armature current keeps the contacts of the indicating relay (9) open, and the contacts of the field current relay (8) are open. When the motor pulls into step the contacts of these relays (8 and 9), which are in series, close, thus completing a circuit which operates an alternating-current shunt relay (10). This relay completes its own holding circuit and in addition short-circuits the coil of the alternating-current shunt relay (4), which opens, and opens the star-point breaker (5).

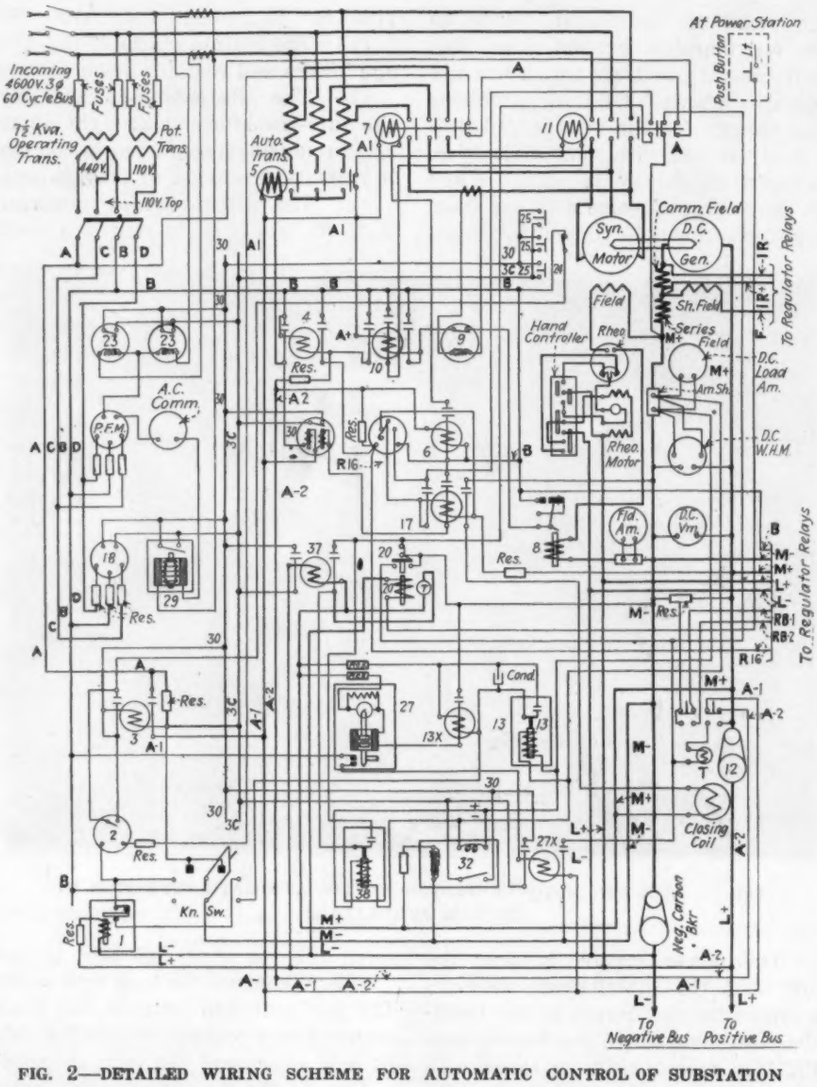


FIG. 2—DETAILED WIRING SCHEME FOR AUTOMATIC CONTROL OF SUBSTATION

This leaves the machine connected to the alternating-current line through the auto-transformers, which act as reactances and hold the synchronous motor in step. As the star point breaker (5) opens, an interlock on it completes a circuit which closes the running breaker (11).

While the set is coming up to speed the voltage-balancing relay (39), which is shown in the diagram Fig. 3, has its contacts (39-R) closed. This means that the secondary relay (14-R) operates and tends to raise

the generator voltage. While the alternating-current shunt relay (4) or secondary relay contact (14-R) is closed the coil of the time relay (16) is short-circuited and does not operate. As the generator voltage builds up after synchronous speed is reached, the voltage-balancing relay (39) operates to balance the generator voltage against the direct-current bus voltage. After these remain equal for two or three seconds the short circuit around the coil of the time relay is removed (16), and its contact on closing energizes the coil of the direct-current shunt relay (17), which closes and thus closes the positive generator breaker (12). This breaker in

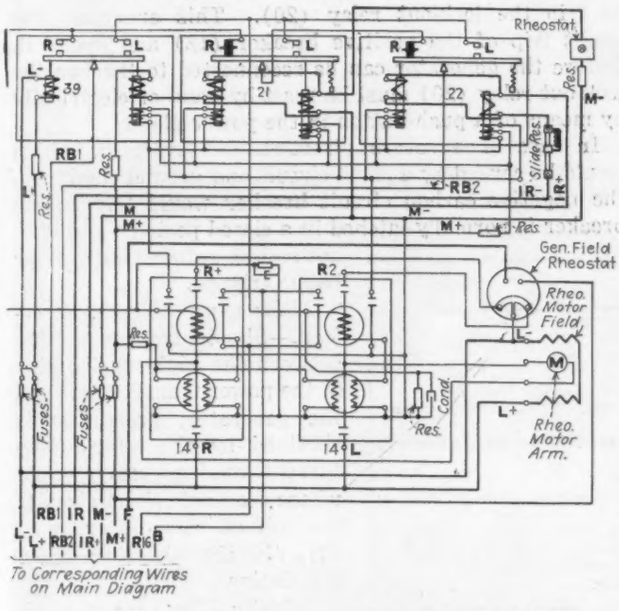


FIG. 3—SCHEMATIC DIAGRAM FOR VOLTAGE-REGULATING EQUIPMENT

closing deënergizes bus *A*-2, and thus opens the starting breaker (17) when the alternating-current shunt relay (6) opens. This time relay (16) returns to zero position after two or three seconds, and its back contact short-circuits the coil of the direct-current shunt relay. (17). This direct-current shunt relay opens and thus removes voltage from the closing coil of the positive machine breaker (12), so that it remains mechanically latched.

The closing of the positive machine breaker (12) takes the control of the field-rheostat (14-R and 14-L) contactors entirely away from the voltage-balancing relays (13-R and 13-L) by opening an auxiliary switch on the positive machine breaker (12). Control is now given to voltage regulating relay (21) and overload limit relay (22).

The contact beam of the overload limit relay (22) acts so that the contacts (22-R) are closed until the load on the direct-current generator reaches 125 per cent normal as indicated by the millivolt drop across the commutating-pole field winding to which the coils of this relay (22) are connected. With the contact (22-R) closed the position of the contacts of voltage-regulating relay (21) governs the control of the secondary relay (14-R and 14-L) and thus the generator voltage.

As the generator has just been connected to the direct-current bus the contact of the voltage-regulating relay (21-R) is closed and the voltage rises until the 125 per cent load point is reached or until the generator voltage is brought to 250 volts, at which point it will remain. If the load on the set increases the overload relay contact (22-L) closes, operates the secondary relay (14-L) and lowers the field excitation to reduce the generator voltage.

It is thus seen that before paralleling the generator on the bus the generator voltage is balanced against the bus voltage by means of the voltage-balancing relay (39), and the two voltages must remain equal for two or three seconds. After connecting the generator to the bus the control of load is taken up by the voltage-regulating relay (21) and the voltage is kept at 250 volts unless the load reaches 125 per cent normal, at which point the control is taken over by the overload limit relay (22) to reduce the generator voltage until satisfactory load is obtained.

ANTI-HUNTING FEATURE OF REGULATOR EQUIPMENT

The automatic regulator diagram shows extra coils at the bottom of each plunger. Suppose the voltage-regulating relay operates to raise the voltage of the generator, the contact of the voltage-regulating relay (21-R) closes and establishes a circuit to operate the secondary relay (14-R). An interlock on this relay energizes one-half of the extra anti-hunting coils. This causes the contact of these two relays (21-R and 14-R)

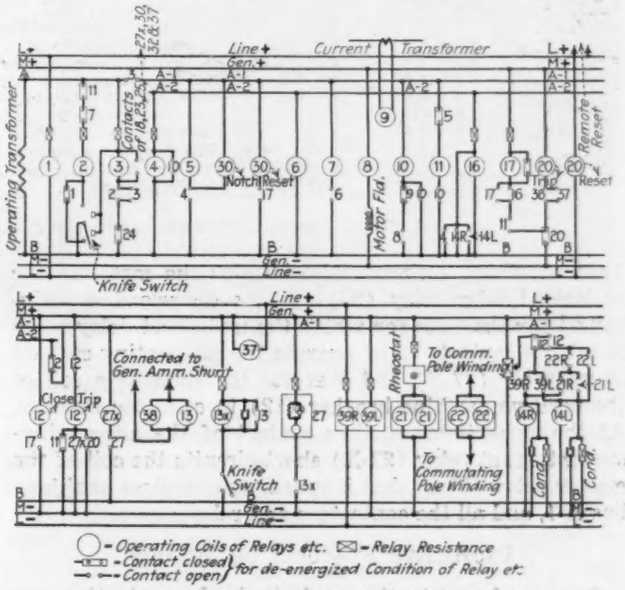


FIG 4—SIMPLIFIED DIAGRAM OF RELAY CONNECTIONS

Key to Apparatus:

1. Primary d.c. voltage relay.
2. Time-delay relay.
3. Master relay (a.c. shunt).
4. A.c. shunt relay.
5. Star-point breaker (contactor in oil).
6. A.c. shunt relay.
7. Starting breaker (contactor in oil).
8. Field-current relay.
9. Low-current indicating relay.
10. A.c. shunt relay.
11. Running breaker (contactor in oil).
12. Positive machine breaker (electrically operated).
13. Underload relay.
13x. D.c. shunt relay.
14R. Secondary relay (closed when raising field excitation).
14L. Secondary relay (closed when lowering field excitation).
16. Time relay (single-pole, double-throw).
17. D.c. shunt relay.
18. Low-voltage and reversed-phase relay.
20. Lock-out relay.
21. Voltage-regulating relay.
21R. Closed when raising voltage.
21L. Closed when lowering voltage.
22. Overload-limit relay.
22R. Closed on underload.
22L. Closed on overload.
23. A.c. overload relays.
24. Overspeed trip.
25. Bearing thremostat.
27. Underload-delay relay.
27x. A.c. shunt relay.
29. Thermal relay.
30. Lock-out relay.
32. D.c. reverse-current relay.
37. Overvoltage relay.
38. D.c. overload relay.
39. Voltage-balancing relay.
39R. Closed when raising voltage.
39L. Closed when lowering voltage.

to open before the machine voltage actually reaches the voltage desired. This is done because the generator voltage change lags a little behind the change in field current.

Suppose the voltage-regulating relay (21-L) closes to lower the generator voltage. The secondary relay (14-L) operates and starts lowering the voltage. An interlock on this relay energizes the other halves of the anti-hunting coils and so causes the contact of the voltage-regulating relay to open and the rheostat motor to stop before the voltage actually reaches the desired point. The voltage then settles after a short time to a value corresponding to the field excitation. The anti-hunting coils operate in a similar manner on overload-limit relay (22) and voltage-balancing relay (39).

METHOD OF SHUTTING DOWN

Shutting down of the motor-generator set is dependent upon the position of the underload relay (13). When the load on the generator falls to or below a predetermined value the contacts of this relay open and thereby allow the direct-current shunt relay (13-X) to close.

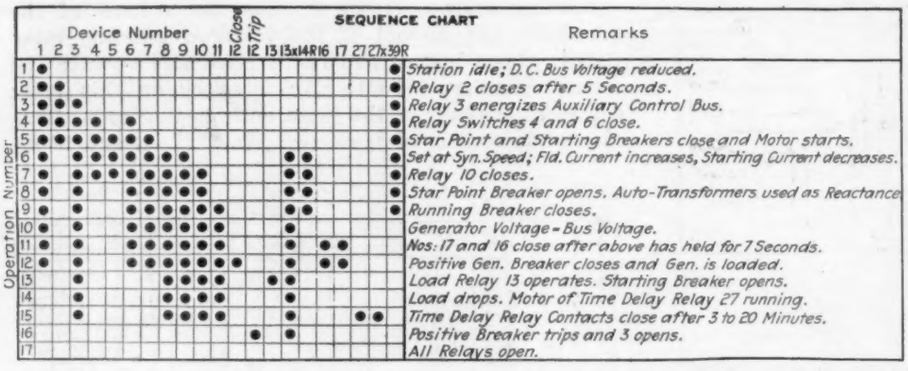

SEQUENCE CHART
Device Number
1 2 3 4 5 6 7 8 9 10 11 12 Close 12 Trip 13 13x 14 R 16 17 27 27x 39R
Remarks
Operation Number
1 Station idle; D.C. Bus Voltage reduced.
2 Relay 2 closes after 5 Seconds.
3 Relay 3 energizes Auxiliary Control Bus.
4 Relay Switches 4 and 6 close.
5 Star Point and Starting Breakers close and Motor starts.
6 Set at Syn. Speed; Fld. Current increases, Starting Current decreases.
7 Relay 10 closes.
8 Star Point Breaker opens. Auto-Transformers used as Reactance
9 Running Breaker closes.
10 Generator Voltage = Bus Voltage.
11 Nos. 17 and 16 close after above has held for 7 Seconds.
12 Positive Gen. Breaker closes and Gen. is loaded.
13 Load Relay 13 operates. Starting Breaker opens.
14 Load drops. Motor of Time Delay Relay 27 running.
15 Time Delay Relay Contacts close after 3 to 20 Minutes.
16 Positive Breaker trips and 3 opens.
17 All Relays open.

FIG. 5—SEQUENCE CHART FOR AUTOMATIC SUBSTATIONS

This completes a circuit which starts the motor of the underload delay relay (27). If the underload is maintained for the time for which the underload delay relay is set, its contacts close, operate the alternating-current shunt relay (27-X) and energize the shunt-trip coil of the positive machine breaker (12) to open the breaker. At the same time, another contact of the alternating-current shunt relay (27-X) short-circuits the coil of the master relay (3) so that it opens, de-energizes auxiliary bus *A*-1, and all the contactors and relays open.

PROTECTIVE FEATURES OF STATION

Reverse-phase starting and single-phase starting are prevented by the closing of the contacts, of the reverse phase and the low-voltage relays (18), which short-circuits the coil of the master relay (3).

Low Voltage.—If the alternating-current line voltage is too low for satisfactory operation, the time-delay relay (2) will not operate, the contacts of the low-voltage and reversed-phase relay (18) close, and the station is prevented from starting. Should low alternating-current voltage occur while the station is in operation, the contacts of the relay (18) close to open the master relay (3).

Direct-Current Overload.—As stated already, under the scheme of operation the overload-limit relay (22) reduces the generator voltage to keep a maximum load of 125 per cent normal on the generator. If the generator voltage is lowered as much as the rheostat permits and the load is still too large, the motor-generator set will carry the overload until the thermal relay (29) connected to a current transformer in motor lead operates to trip the master relay (3). In other words, the thermal relay (29) takes care of continued overload. The thermal relay (29) is calibrated so that its temperature-time curve is steeper than that of the motor; therefore it will operate before the motor windings reach a dangerous temperature. The thermal relay automatically resets after its element and the machine cools sufficiently. The direct-current overload relay (38) operating from the generator shunt is set to operate on approximately 250 per cent load and its contacts close to trip the lock-out relay (20). This energizes the shunt trip of the positive breaker (12) and opens it. Before the generator can be reconnected to the bus the lock-out relay (20) must be reset by hand or electrically by means of a push-button in the power plant.

In case of a severe direct-current overload, which would be caused by a short circuit and ground combined, the negative carbon circuit breaker would trip. This breaker is normally latched in a closed position and does not reclose automatically after being tripped.

Alternating-Current Overload.—Should trouble develop between the high-tension side of the power transformers and the generator, protection is obtained by the alternating-current overload relays (23), whose contact short-circuits the coil of the master relay (3), thereby shutting down the station.

Polarity.—In case the direct-current generator voltage builds up with reverse polarity, the overvoltage relay (37) connected between the generator positive and the bus positive opens the master relay (3), and this locks out the station, necessitating a visit of the inspector to reverse the polarity.

Reverse Current.—The equipment includes the usual direct-current, reverse-current relay (32), whose contact short-circuits the coil of the master relay (3).

Overspeed.—The usual speed-limit device (24) mounted on the motor-generator set furnishes protection from overspeed by opening the master relay (3).

Bearing Protection.—A bearing thermostat (25) is mounted in each bearing of the motor-generator set and operates to open the master relay (3) when any bearing reaches a temperature of 100 deg. C.

Lock-out Feature.—This feature is provided by the lock-out relay (30), which operates each time the star-point breaker (5) closes and is reset to zero position each time the direct-current relay (17) operates to close the positive breaker (12). If this breaker closes three times before the direct-current shunt relay (17) closes, the station is locked out until the lock-out relay (30) is reset by hand.

Continuous Running.—If the two-pole, double-throw knife switch is thrown to the left the station will start and run with all the automatic protective features.

Shutting Down by Hand.—The inspector can shut the station down by opening the knife switch so that one of its blades touches the special jaw which forms a circuit shunting the coil of the master relay (3).

Developing Power of the Potomac River

It Is Estimated That 61,000,000 Kw.-Hr. May Be Obtained Annually for the District of Columbia by Providing Adequate Storage—Water May Also Be Used for Domestic Purposes Through the Carrying Out of This Project

By JOHN C. HOYT
Hydraulic Engineer U. S. Geological Survey, Washington, D. C.

THE GREAT FALLS OF THE POTOMAC RIVER, WHERE IT IS PROPOSED TO DEVELOP HYDRO-ELECTRIC POWER FOR THE DISTRICT OF COLUMBIA

AMONG the provisions of the new water-power act is one carrying an appropriation to cover the expense of an investigation of the power possibilities in the Potomac River for the supply of electrical energy to the District of Columbia. By a study of records of stream flow in the Potomac drainage area covering about twenty-five years it has been shown that by proper storage an adequate flow may be obtained for a low-water period as severe as any on record, thus avoiding the necessity of a steam auxiliary plant.

The last paragraph of Section 7 of the act reads as follows:

"The commission is hereby authorized and directed to investigate and on or before the first day of January, 1921, report to Congress the cost and, in detail, the economic value of the power plant outlined in project numbered 3, House Document numbered 1,400, Sixty-second Congress, third session, in view of existing conditions, utilizing such study as may heretofore have been made by any department of the government; also in connection with such project to submit plans and estimates of cost necessary to secure an increased and adequate water supply for the District of Columbia. For this purpose the sum of $25,000, or so much thereof as may be necessary, is hereby appropriated.

The plan referred to provides for construction of the dam on the Potomac River below Great Falls, which will produce an effective head of about 112 ft. (34 m.). On account of the low minimum flow of the river the ultimate development at this point will depend largely on either a steam auxiliary or storage to supplement the low-water flow.

In 1908 M. O. Leighton and A. H. Horton, engineers of the United States Geological Survey, made office studies of the storage possibilities at certain sites in the headwaters of the Potomac watershed, using as a basis the records of stream flow covering a period of twenty-five years, topographic maps and other available data relative to the Potomac watershed. This study covered only a portion of the basin, and other sites, some of which have been investigated by other agencies, are known to exist. In this investigation, the results of which are published as U. S. Forest Service Circular 143, under the title of "The Relation of the Southern Appalachian Mountains to Inland Water Navigation," six

RESERVOIRS IN POTOMAC RIVER BASIN

Stream and Location	Catchment Area, Sq. Miles	Mean Annual Run-off per Square Mile, Cu.Ft. per Second	Flow Available Cu.Ft. per Second	Capacity of Reservoir, Million Cu.Ft.	Capacity of Reservoir in Catchment Area, Sq.Miles	Height of Dam, Feet	Area of Flow Line, Acres
North Fork, South Branch, Potomac River at Petersburg, W. Va.	460	1.12	520	18,550	460	134	7,600
North Fork, Shenandoah River, Rockingham County, Va.	210	0.84	180	6,910	210	92	3,410
North River, Rockingham County, Va.	290	1.33	390	14,150	290	96	9,710
Middle River, Augusta County, Va.	180	1.33	240	6,190	140	100	4,250
South Fork, Shenandoah River, Rockingham County, Va.	500	1.42	710	2,290	50	40	3,930
	200	1.42	280	10,420	200	95	7,150

reservoir sites were studied as indicated in the accompanying table.

For the twenty-one climatological years ended Sept. 30, 1917, the flow of the Potomac River at Point of Rocks was less than 2,000 second-ft. (56.6 cu.m. per second) on an average of forty-three days a year and less than 2,500 second-ft. (70.7 cu.m.) on an average of seventy-one days a year.

Assuming that in the Potomac basin reservoir capacity amounting to that of the six reservoir sites in the above table is feasible of development and that half of this capacity can be utilized annually, 29,200,000,000 cu.ft. (826,000,000 cu.m.), there would be sufficient water to produce 61,600,000 kw.-hr. of energy at the proposed power site, assuming a plant efficiency of 80 per cent and using a fall of 112 ft. (34 m.).

The six reservoir sites referred to have a total capacity of 58,500,000,000 cu.ft. (1,660,000,000 cu.m.), which is equivalent to a mean annual flow of 1,850 second-ft. (52.3 cu.m.).

Records of flow of the Potomac River at Point of Rocks, Md., from June 1, 1896, to Dec. 31, 1919, show the following:

Mean—9,810 second-ft. (268 cu.m.).
Maximum—March 2, 1902, 219,000 second-ft. (6,180 cu.m.).
Minimum—Sept. 10, 1914, 540 second-ft. (15.3 cu.m.).

The longest and lowest low-water period was from May 14, 1914, to Jan. 5, 1915, during which the following flow was recorded:

Mean—2,950 second-ft. (83.5 cu.m.).
Maximum—Dec. 9, 1914, 15,700 second-ft. (443 cu.m.).
Minimum—Sept. 10, 1914, 540 second-ft. (15.3 cu.m.).

Mass-curve studies for the period covered by this low-water flow indicate that the reservoirs referred to, if full, would have provided one and eight-tenths times the amount of water necessary to maintain a uniform flow of 4,000 second-ft. (113 cu.m.) during said low water period of 236 days; three and three-tenths times the amount necessary to maintain a flow of 3,000 second-ft. (85 cu.m.), and eight and four-tenths times the amount necessary to maintain a flow of 2,000 second-ft. (56.6 cu.m.) One reservoir alone, shown in the table, has sufficient capacity to maintain a flow of 2,000 second-ft.

These preliminary studies indicate that, if the reservoir sites can be economically developed, storage may be an important factor in the development of the Potomac River as a source for power and water supply for the District of Columbia.

In this connection it may be noted that before starting investigations the Miami Conservancy District did not consider that there was any possibility of finding storage reservoir sites in the Miami basin of sufficient size and feasible of construction to control the floods. Nevertheless, in order that their study might include all phases of the flood-control problem, storage was investigated, and as the result reservoirs were found to be the most economical and feasible solution of the flood problem, and six or seven reservoirs are now being constructed which are expected to protect the Miami River basin from all future floods.

The comparison of the topography and land value in the Potomac and Miami basins led to the belief that the possibilities for developing storage in the Potomac are as good as in the Miami, if not better. They at least warrant careful consideration in connection with a study of the utilization of this basin.

Preliminary Power Permits Under Consideration

Federal Power Commission Announces List of Applications Under New Act—Every Section of Country Represented Except New England

ON AUG. 15 the Federal Power Commission at Washington made public the first list of applications for preliminary permits or licenses made under the provisions of the new water-power act. In accordance with Section 5 of the act these preliminary permits are for the sole purpose of maintaining priority of application for license under the terms of the act for a period not exceeding three years, while examination and survey for preparing the necessary maps, specifications, estimates and financial arrangements are under way.

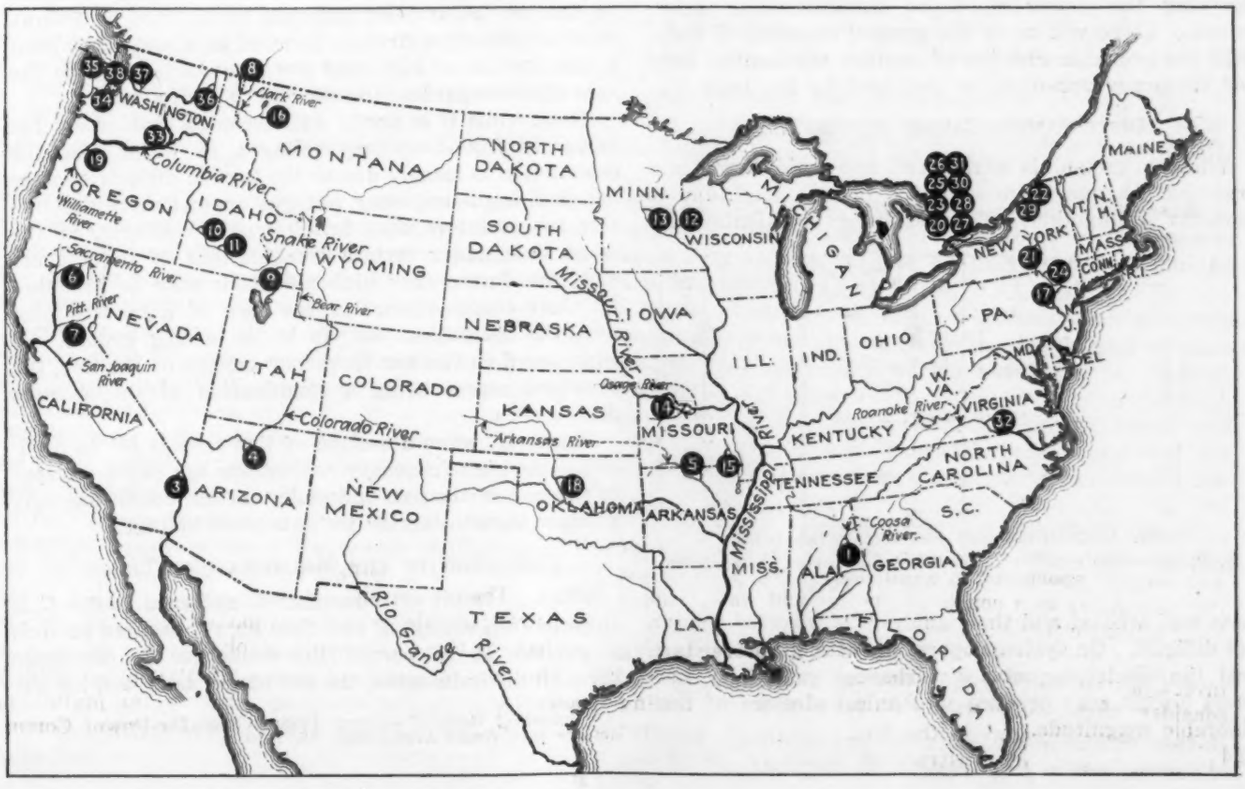
The list given below includes thirty-eight applications for power projects, distributed, as indicated on the accompanying map, in every section of the country except New England. Several comparatively unknown projects are included, while for a large number of the more important projects applications for preliminary permits have not as yet been made. The fact that no applications have been made for projects in New England is rather surprising. A large amount of attention is being paid to the fuller development of the Niagara River and the Falls, some eight applications having been filed for this project. Four other projects relate to sites in the State of New York. Considerable activity in future water-power development in Washington is indicated by the filing of six applications from that state. The commission has not made public the amount of power possible from the complete development of each project, or the investments involved.

The map on page 423 shows approximate location of power projects for which applications for preliminary permits are now on file with the Water-Power Commission at Washington.

APPLICATIONS FILED FOR PRELIMINARY WATER-POWER PERMITS

Map Reference No.	State	Applicant	Address of Applicant	Location of Project
1	Alabama	Alabama Power Co	Birmingham, Ala	Coosa River in Alabama below Government Lock No. 2.
2	Alaska	Speel River Power Co	418 Foxcroft Bldg., San Francisco	In vicinity of Speel River in Tongass National Forest, Alaska.
3	Arizona	Beckman & Linden Corp	(See this application listed under California applications.)	
4	Arizona	C. A. Heberlein	Prescott, Arizona	Cataract Canyon, Coconino County, Ariz.
5	Arkansas	Dixie Power Company	33 Metropolitan Bldg., Chicago	White River near Cotter, Baxter County, Ark.
6	California	Pitt River Power Co	San Francisco, Cal	Pitt River, California.
7	California	R. W. Hawley	833 Market St., San Francisco	Silver Creek and branches, Eldorado County, Cal.
3	California	Beckman & Linden Corp		Colorado River in Arizona and California.
8	Idaho	G. W. Spoerry	Bonners Ferry, Idaho	Moyie Falls on Moyie River, Idaho.
9	Idaho	Utah Power & Light Co	Augusta, Me	Soda Point, Lava, Narrows and Mink power sites on Bear River, Idaho.
10	Idaho	Idaho Power Co	Boise, Idaho	Upper Salmon Falls on Snake River, Idaho.
11	Idaho	Idaho Power Co	Boise, Idaho	Twin Fallson Snake River, Idaho.
12	Minnesota	J. D. Markham	512 Globe Bldg., St. Paul, Minn	Kelsey-Markham-Druar dam site on St. Croix River, bet. Minn. and Wis.
13	Minnesota	St. Cloud Water Power Co	St. Cloud, Minn	Mississippi River in Stearns and Sherbune County, Minn.
14	Missouri	W. R. Banks	Lock box 1005, Lamar, Mo	Osage River bet. Warsaw and Tuscumbia, and on Niangua River. between Hahatonka and mouth of Little Niangua River, Mo.
15	Missouri	Western Tie & Timber Co	905 Syndicate Trust Bldg., St. Louis	Current River in Ripley, Carter and Channon Counties, Mo.
16	Montana	Rocky Mountain Power Co	Butte, Mont	Flathead River below outlet of Flathead Lake.
17	New Jersey	Canada Syndicate, Ltd	Duncan Young & Co., New York	Delaware River above Belvidere, N. J.
18	Oklahoma	C. P. Chenault	Tulsa, Okla	Ox Bow Bend, Arkansas River, Okla.
19	Oregon	Crown Williamette Paper Co	Pittock Block, Portland, Ore	Falls of Willamette River, West Linn., Ore.
20	New York	City of Buffalo	Buffalo, N. Y	Niagara River.
21	New York	Henry Ford & Son, Inc	Dearborn, Mich	Green Island, Government Dam on Hudson River, Troy, N. Y.
22	New York	Louisville Power Corp	Massena, N. Y	St. Lawrence River, Croil Island to east end of Gooseneck Island, N. Y.
23	New York	Hydraulic Race Co	Lockport, N. Y	Niagara River.
24	New York	Paul T. Brady	165 Broadway, New York	Delaware River, between Barryville, N. Y., and Shohola, Pa.
25	New York	Lower Niagara River Power & Water Supply Co	Lewiston, N. Y	Niagara River at Cleveland Ave., and Niagara Ave., City of Niagara Falls, N. Y.
26	New York	Niagara County Irrigation & Water Supply Co	Lewiston, N. Y	Niagara River, New York.
27	New York	Niagara Falls Power Co	Niagara Falls, N. Y	Niagara River, divert water above Falls, N. Y.
28	New York	Niagara, Lockport & Ontario Power Co	Marine Trust Co. Bldg., Buffalo	Niagara River, divert water above Falls, N. Y.
29	New York	St. Lawrence Transmission Co	Potsdam, N. Y	Vicinity of Long Sault Rapids, St. Lawrence River, N. Y.
30	New York	Thomson & Porter	DeWitt Clinton Bldg., Buffalo	Niagara River, N. Y.
31	New York	Niagara Gorge Power Co	604 Ellicott Square, Buffalo	Niagara River, direct water above Falls, N. Y.
32	Virginia	Roanoke River Development Co	318 Mutual Bldg., Richmond, Va	Roanoke River between Bugg's Island and town of Clarskville, Va.
33	Washington	Washington Irrigation & Development Co	905 White Bldg., Seattle	Priest Rapids, Columbia River, Wash.
34	Washington	Alex. Polson	Montesano, Wash	Headwaters of Wynooche River, Olympic National Forest, and northeastern part of Gray's Harbor, Wash.
35	Washington	Northwestern Pwr. & Mfg. Co.	Donworth, Todd & Higgins, Hoge Bldg., Seattle	Lake Crescent, Elwha River, Wash.
36	Washington	Hugh L. Cooper	101 Park Ave., New York	Clark Fork of Columbia River, Wash.
37	Washington	Sound Power Co	25 Broad St., New York	Sultan River and Olney Creek, Snohomish County, Wash.
38	Washington	Straits Power Co	25 Broad St., New York	Soldue River, Crescent Lake and Lyre River, Clallam County, Wash.

MAP SHOWING LOCATION OF THE ABOVE APPLICATIONS FOR PRELIMINARY POWER PERMITS. THE INTENSE INTEREST IN HYDRO-ELECTRIC DEVELOPMENTS IN THE STATES OF NEW YORK AND WASHINGTON IS CLEARLY INDICATED. SUBSEQUENT APPLICATIONS MAY POINT TO A WIDER DISTRIBUTION OF DEVELOPMENT UNDER THE NEW WATER POWER ACT



Arcing Grounds on High-Tension Lines

Experimental Investigation of the Voltage Stress on Insulators and Connected Apparatus on High-Tension Transmission Lines Due to the Normal-Frequency Voltage and the High-Frequency Surges Caused by Arcing Grounds

By W. D. A. PEASLEE
Electrical Engineer Jeffrey-Dewitt Insulator Company

THE occurrence of a ground on a transmission line gives rise to different forms of disturbance, depending for their relative magnitudes upon the particular conditions at the time of grounding and upon the electrical constants of the line. While these conditions are susceptible of mathematical analysis, it was considered of great importance to know to what extent such high-pressure stresses do occur in transmission lines and the connected apparatus. The investigation here described was undertaken to discover if possible to what extent the operating conditions could be reproduced and the mathematical analysis verified.

While a great deal of work remains to be done before the complete equations for the phenomena related to arcing grounds can be established, the general nature of the overvoltages is shown and the results of the tests indicate that arcing grounds do subject transmission-line insulators to voltage stresses far in excess of those met in normal service, and that these stresses are dependent on the operating voltage, the line constants and the position of the arcing ground on the line. With more data as to the variation of the stresses with frequency in a given case, it will be possible to determine with reasonable accuracy the stresses that the insulators of any line will have to stand by assuming arcing grounds at different points on the line and applying the power equations experimentally determined. These will be of the general exponential form, with the probable addition of another exponential term for frequency variation, as indicated by the tests.

Disturbances Caused by Grounds

When a ground is permanent and solid there is a transient change from stability in one condition to stability in another. The resulting transients have

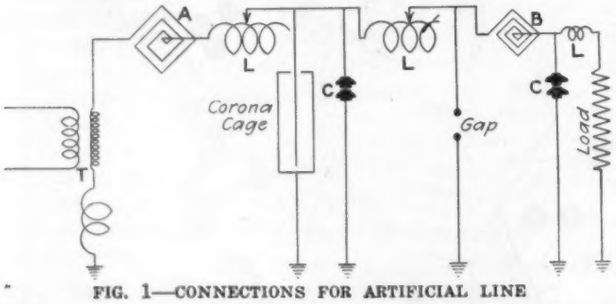


FIG. 1—CONNECTIONS FOR ARTIFICIAL LINE
A, B, protective helixes; *L,* loading inductances; *C,* insulator condensers; *T,* transformer.

been well studied and their analysis is involved though not difficult. On systems operating with grounded neutral the electromagnetic disturbances caused by this short circuit may produce mechanical stresses of considerable magnitude.

When the ground is unstable in character a series of transient waves will be set up each time the ground is made and broken. As long as the current in the power arc is constant there will be no tendency toward oscillation in the line, but with a variation in this

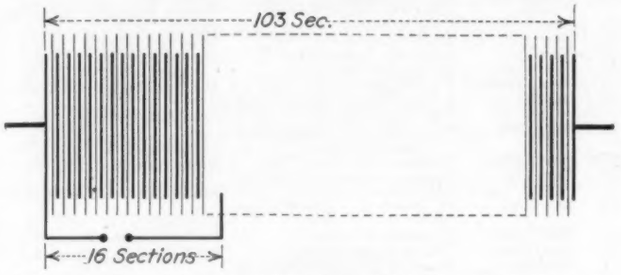


FIG. 2—MULTI-SECTION CONDENSER USED AS POTENTIOMETER

current the conditions will change. On the breaking of the arc the condenser, consisting of the capacitance of the line, will discharge across the gap, and the line will oscillate in sections on each side of the point of the ground, at a frequency depending on the length and constants of the sections involved.

It has been shown by Ryan* that the effect of a superposition of high frequency upon low audio-frequency voltages was to give the combination a sparking distance equal to the sum of the sparking distances of the two separately, and this being true, it follows that the dielectric stresses imposed on a system by such a combination of high and low frequencies may be the sum of the separate stresses due to each alone.

Thus, while it is pretty well accepted that except for sustained high-frequency voltages, in which case the destruction is largely due to the terrific dielectric losses entailed, high-frequency voltages are not more destructive to insulators than low-frequency voltages, at the same time under certain combinations of inductances and capacitance very high potentials may be produced by their combination. In the case of a transmission line, the oscillations set up by an arcing ground are superposed on the low-frequency voltage of the line, the resultant stress being a combination of the stresses due to each.

Moreover, when a section of line is thus set in oscillation the high-frequency oscillations are communicated to the rest of the line and under certain conditions may produce therein terrific instantaneous voltages.

Discussion of the Mathematical Theory

When a circuit of inductance L and capacitance C is charged to a voltage E and then short-circuited in such a manner as to permit the condenser to discharge through the inductance, the discharge, as is well known,

*"Sustained Radio-Frequency High-Voltage Discharge," *Transactions Inst. Radio Engs.*, Sept. 16, 1915.

is oscillatory, involving a transfer of energy from the electrostatic to the electro-magnetic field in successive oscillations in such a manner that, neglecting the factor by which the stored energy is dissipated, the maximum electromagnetic energy must equal the maximum electrostatic energy, or

$$LI_m^2/2 = CE_m^2/2.$$

E_m = maximum transient voltages.

I_m = maximum transient current.

However, owing to the resistance of the circuit, the energy is dissipated and the succeeding maximum values of electrostatic and electromagnetic energy decrease according to an exponential law.

From these facts we get the well-known relation

$$\frac{E_m}{I_m} = \sqrt{\frac{L}{C}} = Z,$$

or what is called the surge impedance of the line. The physical significance of this factor may perhaps be better understood when we say that it is the impedance offered at any point to an advancing wave of the frequency given by these line constants. From this we get at once $E_m = I_m Z$, and so if I_m or E_m is known the other can be computed. Thus the voltage is equal to the current in the arc times the surge impedance of the line, and the current is a function of operating voltage and line constants or of the location of the ground.

Since the maximum electrostatic and electromagnetic energies must be equal, we see further that $Li^2/2 + Ce^2/2 = \text{constant} = K$, where i = instantaneous current, e = instantaneous voltage.

From these conditions it will be seen that the current is a maximum when the voltage is 0 and vice versa, so if the voltage is a sine function the current will be a cosine function, and we shall then have, neglecting the factor by which the energy is dissipated:

$$i = I_m \cos(\phi - \gamma)$$

$$e = E_m \sin(\phi - \gamma)$$

wherein $\varphi = 2\pi$ ft. and γ is the phase angle at the moment the oscillations start, or $i_1 = I_m \cos \gamma$ is the value of the oscillating current at the moment of starting the oscillation. Likewise $e_1 = E_m \sin \gamma$ is the value of the oscillating voltage at the moment of starting the oscillation.

Given, then, the constants of the line and I_m or E_m, and knowing the instant at which the oscillations start, we can completely determine the resulting oscillating transient.

Thus in the case of an arcing ground on a transmission line E_m is the maximum voltage to ground and is known, and from it we can determine I_m, and if the phase angle of the starting point is known we can determine the oscillating transient completely.

Therefore, in the case of a transmission line with an arcing ground the total dielectric stress resulting will be the normal-frequency voltage stress plus the high-frequency oscillating transient stress applied in the form of series of highly damped trains obeying the above equations.

Again, if a line is short-circuited and the short-circuit current I_m is suddenly broken, the maximum voltage that can be induced is $I_m Z$. Thus in an arcing ground on a transmission line, especially when the neutral is grounded, but to a considerable extent even with isolated neutral, we find on the making of the ground a determinable oscillating current of maximum value I_m and on the breaking of the ground a determinable oscillating voltage of maximum $E_m = I_m Z$, where I_m is the maximum current to ground and is dependent on the position of the ground and on the line constants.

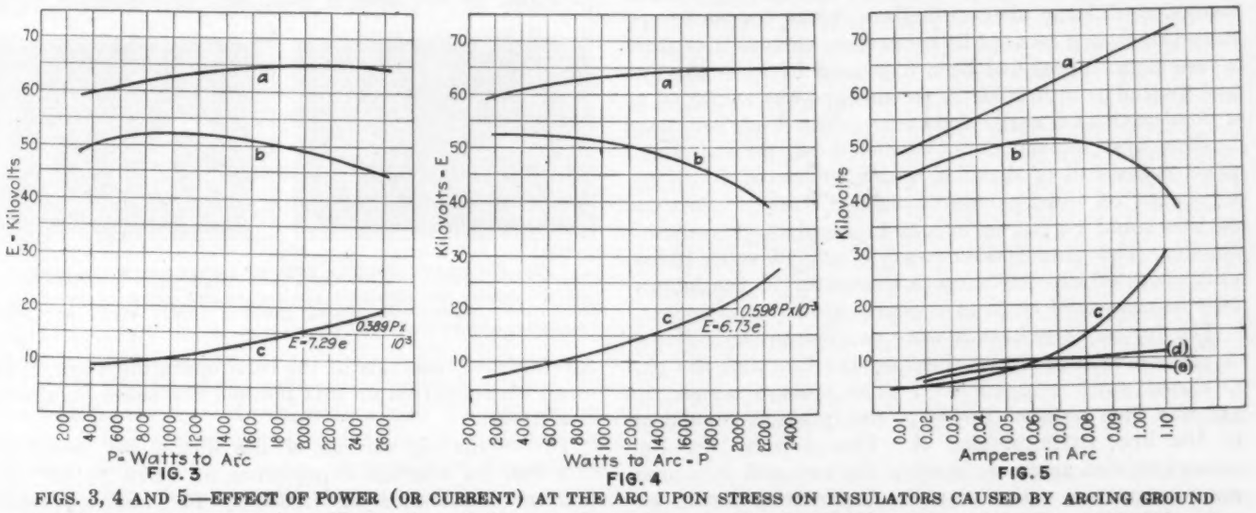


FIG. 3 FIG. 4 FIG. 5

FIGS. 3, 4 AND 5—EFFECT OF POWER (OR CURRENT) AT THE ARC UPON STRESS ON INSULATORS CAUSED BY ARCING GROUND

Oscillation frequency varies with location of the ground, as shown in Fig. 3, 740,000 cycles, and in Fig. 4, 960,000 cycles. Curve *a* shows total voltage stress; *b*, that due to 60-cycle voltage, and *c*, the high-frequency oscillation component. Curves (*d*) and (*e*), Fig. 5, give oscillation voltage on five outside end turns of inductances *a* and *b* (Fig. 1), for oscillation frequency of 740,000 cycles.

This oscillating current in combination with the constants of the line may cause high-voltage stresses in the line, especially at transition points, such as connected transformers or cables attached to it, which are added to the normal-frequency voltage stress, and the oscillating voltage caused by the rupture of the ground current also adds its stress to the normal-frequency voltage stress.

From these relations it is not a difficult matter to evolve the general equations of the line under arcing ground which appear in one form as:

$$I = D_1 e^{-\frac{\theta t}{c}} + D_3 e^{-\frac{rt}{L}}$$

$$E = \sqrt{\frac{L}{c}}\, e^{-\omega t}\left[D_2 e^{-\frac{\theta}{c}(t+t_0)} + D_4 e^{-\frac{r}{L}(t+t_0)}\right]$$

These equations are simply a mathematical expression of the fact that in a transmission line subject to

arcing grounds there will be superposed on the easily calculated normal-frequency voltage and current waves transient waves of voltage and current of frequency dependent, in a given line, upon the location of the ground from transition points in the line, as the section between the ground and transition point will oscillate at a frequency determined by the constants of the section. Thus the section on either side of the ground will in general oscillate at different frequencies, and in certain rare cases the two sections will resonate. In any case disturbances from each section will be reflected in to the other, and it is readily seen that the situation becomes very complex in a short time (measured in micro-seconds). The following experiments were undertaken in an attempt, partially successful, to isolate the effects of such a condition.

ARRANGEMENT OF ARTIFICIAL LINE

An experimental line was built up of massed constants as indicated in Fig. 1 (massed constants were used because of the expense of building one with even approximately distributed constants), and an artificial arcing ground was placed on the line as indicated.

The inductance of the line was lumped as shown and consisted of large air-core helixes, while the necessary capacitance was secured by connecting various insulators whose capacitances had been measured between the line and ground as indicated. A corona cage was employed as a condenser and surge indicator. The load, not used in the first experiments, consisted of several small glass tubes full of distilled water connected in zigzag by means of short pieces of rubber tubing. Sections of this could be cut in or out to regulate the current drawn. The transformer was a 125,000-volt, 10-kw. unit operated directly from a generator in the laboratory so connected as to give nearly a pure sine wave.

The initial experiments were carried out as follows: A certain voltage E was held on the line and the gap G closed until it arced over. The voltage across the arc was then reduced, owing to the inherent regulation of the line, extinguishing it. This permits the line voltage to rise again, reforming the arc, and this process is repeated, rather rapidly duplicating almost exactly the action of an actual line under arcing ground. This work was carried out in the dark, and with the spark shielded it was possible to see, by the increase of corona on the corona rod and on the insulator pins, that a quite appreciable increase in voltage on the insulators resulted on every making and breaking of the arc. The results, however, were so transient that they could not be recorded, so the gap was replaced by a rotary gap which made and broke the arc very rapidly and continuously, thus maintaining the desired effects.

The insulators used as condensers in this line are in the same relation to the normal frequency and transient voltages as the insulators of lines under operation commercially; therefore any extra strain found on them traceable to this arcing ground would be a measure of the corresponding insulator duty on a line in operation. The first observations were by means of the extra corona formation on the pins and caps when the arc was in operation. The photographs show this effect, but it will be recognized at once that no quantitative measurement of it was possible in this way.

The evidence of a decided increase in voltage stress on the insulators was very plain. The corona streamers on the corona cage were lengthened several inches, and the corona around the insulator pins became very vicious when the arc was working. It now became necessary to make quantitative measurements of the voltage stress at the insulators. A sphere gap would short-circuit the line on arc-over and was of course not to be considered. A cathode-ray tube would have been ideal, but it was not available.

It therefore became necessary to develop a device to measure, by means of a spark gap, the dielectric stress on an insulator string when under the influence of combined 60-cycle and high-frequency pressure without the formation of a power arc in parallel with the insulator string or changing the constants of the oscillating circuit to an appreciable extent.

MULTI-SECTION CONDENSER USE FOR MEASURING VOLTAGE

The conditions necessitated the use of a device which would give a definite and stable increment of the total stress up to a point of breakdown of the gap and which would not change appreciably the capacitance of the circuit when the gap broke down. The work of Professor Ryan in determining the distribution of the stress on the surface of an insulator, in which he employed a multi-section condenser to secure definite fractions of the total operating voltage, led to an investigation of this method for these particular conditions.

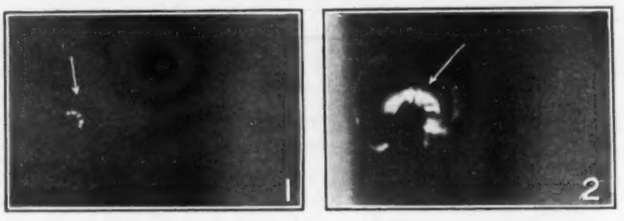


FIG. 6—HEAVY CORONA DUE TO OSCILLATORY VOLTAGE

Left, corona on insulator pin for 58,000 volts, 60 cycle, non-oscillating; right, with arcing ground, 46,000 volts, 60 cycles, oscillation frequency 730,000.

The oscillating section of the line under investigation had an average capacitance of 78.76×10^{-5} mf. and an inductance of 7.103×10^{-5} henries, which with lumped inductance and capacitance gave a natural frequency of 847,550 cycles per second.

A condenser was built up of 103 sections in series, as shown in Fig. 2, each section consisting of thin metal plates, 6 cm. $\times$ 5 cm., with a glass plate 0.1296 cm. thick between the plates, the whole clamped firmly together and immersed in oil. The capacitance of these sections in series was 0.119×10^{-5} mf., and the frequency with this condenser added to the line was 846,900 cycles per second. The spark was placed across sixteen end sections of this condenser, and on breakdown of the gap short-circuiting these sections the capacitance of the remaining eighty-seven sections in series was 0.1414×10^{-5} mf., giving a change in capacitance of 0.0224×10^{-5} mf. in a circuit containing 78.88×10^{-5} mf. Obviously, the change caused by the breakdown of the gap across these sections does not change the conditions of the circuit within the degrees of accuracy obtainable in such experimental work.

This equipment was then calibrated on 60 cycles by determining for various voltages the sphere gap breakdown across the sixteen sections. The results of many such determinations, reduced to standard conditions of barometer and temperature, indicate a very satisfac-

tory integrity. This calibration will not be correct for high-frequency voltages because, owing to the dielectric spark lag, the sphere gap at high frequency indicates a lower voltage than is actually impressed, especially when the oscillations are in the form of rather highly damped trains (the spheres used were small, 3.1 cm. in diameter). The error, however, will be an indication of a lesser stress than that actually put upon the apparatus.

The condenser was supported in oil on hard-wood blocks boiled in oil and the whole device was carefully guarded from stray electrostatic fields and leakage.

With the development of this device the scope of the work was greatly extended and further auxiliary devices became necessary. A means of measuring the combined high-frequency and 60-cycle current was provided by the rebuilding of an old hot-wire voltmeter into an ammeter.

CURRENTS MEASURED WITH HOT-WIRE INSTRUMENT

Data were now taken in order to determine in so far as possible the increase of voltage stress due to this arcing ground as a function of the power feeding into the arc or of the current in the arc. The power in the arc was approximated by subtracting from the input to the transformer on the low-tension side the known losses of the transformer and line. For the current relations current measurements were made with the hot-wire ammeter.

In Fig. 3 *a* is the total stress for the oscillatory case, *b* is the part of this due to the 60-cycle line voltage, and *c* is the duty due to the oscillations, in this case at a frequency of 740,000 cycles per second. The line is unloaded in this test. In Fig. 4 the same curves are shown for different locations of the ground on the same line, giving a frequency of 960,000 cycles per second line unloaded.

In Fig. 5 the same values are plotted against the current in the arc at a frequency of 740,000 cycles. Curves *d* and *e* are voltages across the five outside end turns of inductances *a* and *b*, showing that the sections on each side of the ground were oscillating. Curve *d* is for inductance *a*, nearest the transformer. The higher values of stress indicated on the inductance on the source side of the ground are probably due to the current drawn through inductance *a*, which affects the field distribution and so the distribution of stress. The ordinates are voltage stress across condenser potentiometer or duty on line insulators.

DETERMINATION OF EQUATIONS FOR VOLTAGE STRESS ON INSULATORS

The curves *c*, of Figs. 3 and 4, were plotted with logarithms of the voltage stress as ordinates and the exponential equations of the curves were determined, while the rectangular equations of the curves in Figs. 3, 4 and 5 were determined by the sigma-delta method of reduction. The results of these determinations are summarized below and warrant careful examination:

Fig.	Equations	Frequency
3	$E = 7.20e^{0.389P}$	
	$E = 9.31 + 1.62P^2$	740,000
4	$E = 6.37e^{0.598P}$	
	$E = 8.58 + 3.4P^2$	960,000
5	$E = 5 + 18{,}000I^3$	740,000

The apparent variation of these equations with the frequency of oscillation is very interesting, but until a vast amount of data is available deductions as to this feature of the work are unwarranted. The important point is the establishment of the variables in equations satisfying the data that will give information as to the manner in which the voltage stress is dependent on line conditions.

It will be noted that the initial points of the curves do not satisfy the data. The reason for this is that there is a certain amount of current or power, as the case may be, required to maintain the arc, and values approaching this minimum or below it will naturally be erratic and unreliable; so the equations can be seen to represent the conditions only for values of the variables well above the minimums required to maintain the arc.

INTERPRETATION OF EXPERIMENTAL DATA

The voltage stress is seen to be a function of the power in the arc and specifically of the square of the power. Since the power is a function of voltage and current, it will be seen at once that the position of the arc on a given line is a vital factor in the severity of the voltage stress resulting from the arc. The line voltage for a given line is constant, and the current will depend on the amount of impedance in the line between the arc and the generator or the distance between the arc and the generator. The indications are then that the arcs forming close to the generating station are likely to be much more severe in their effects than those further away for two reasons—first, the power or current concerned is greater, and, second, the frequency of oscillation will be higher. From the equations derived from Figs. 3 and 4 it will be seen that for high frequencies the curve starts at a lower value but increases more rapidly than for low frequencies. The limits within which this holds are not known at present, but it is probable that it does not hold strictly for frequencies much above 2,000,000 cycles. All of these conclusions are amply supported by operating evidence.

The fact that the voltage stress is a function of the cube of the current indicates that the resistance of the arc is also a function of the current, a fact that has been reported by several investigators. If this were not so, the stress would be a function of the fourth power of the current. The evidence is therefore that the fact of the current-resistance characteristic of the arc being negative tends to increase the severity of the arc when once formed. This is another factor in the instability of conditions around the minimum values of power and current required to maintain the arc.

IT IS *inspiring to think that in the flake of snow and in the drop of rainfall man should have discovered little elves full of energy and ready to work for him. It is criminal to continue indefinitely using up our rapidly vanishing fuel reserves while the potential power in our great rivers rushes heedlessly and uselessly down to the sea. Only the armistice intervened to save the industries of the country from a realization of an acute power shortage. What would we say to the railroads if they persisted in speeding long trains of empty cars from the center of the country to the Gulf and the two oceans while freight and people stood beside the tracks awaiting transportation?*—E. K. HALL, *vice-president American Telephone & Telegraph Company.*

The Industrial Load in California

Adoption of Electric Drive in Primary Industries Very General —Central Station Figures for First Quarter of Year Indicate Large Increases in Industrial Load—Advantages of Motors

THERE is perhaps nothing else as potent in the resumption of normal financial conditions as increased production. In virtually all lines of industry reduction in hours of labor has accompanied to a greater or less degree increases in wages. Increased production must, therefore, be accomplished by the same workmen in a shorter time, a seeming impossibility in view of the reports coming from manufacturers of all classes that individual production per hour of employment has lowered since the end of the war. The elimination of unnecessary motions by the workman and the speeding up and constant operation of machinery will help, and the electric motor has a very essential place in this respect.

The recent large growth in the utilization of electrical energy in California industries is clearly accentuated by the central-station returns received from that state by the ELECTRICAL WORLD during the first quarter of this year. Car shortage, unsettled labor conditions and seasonal variation in illumination requirements were factors tending to lower the output of central stations materially, but despite these three adverse conditions the average daily output has gradually increased from 8,832,000 kw.-hr. in January to 9,030,000 kw.-hr. in April.

In an endeavor to ascertain the extent and distribution of this industrial load in California, the ELECTRICAL WORLD sent detail questionnaires to 1,310 industrial concerns. The names of these firms were obtained through the various local chambers of commerce of the state, and the list is believed to represent the total number of primary industrial establishments employing more than fifty operatives each. Fig. 1 shows the distribution of these industrial plants by sections of the state. Answers have been received from 299 companies which were so distributed among various industries as to give a very definite idea of the industrial power situation in California. Some very optimistic conclusions relative to the advantages of electrical energy in industry as a whole are to be drawn from this survey.

GROUPS OF MANUFACTURERS

The Census of Manufactures for 1914 divides all manufacturers into fourteen general groups as follows: Food and kindred products; textiles; iron, steel and their products; lumber and its manufactures; leather and its finished products; paper and printing; liquor and beverages; chemicals and allied products; stone, clay and glass; metal and metal products other than iron and steel; tobacco manufactures; vehicles for land transportation; railroad repair shops, and miscellaneous industries. The principal manufacturing industries in California using electricity as a source of power, as indicated by the survey, are iron and steel, including foundries and machine shops; shipbuilding; cement plants; food, including canning and preserving plants; mining; paper mills and paper products; chemicals, and lumber and lumber products. The accompanying table gives detailed data on the utilization of electric power in these industries as well as in other industries of less importance. Probably the most interesting data in this table show the comparatively small amount of energy generated by private plants. The generation of energy by the private plants of lumber and mining companies is to be expected on account of their isolation and the difficulty in taking care of the waste, but the fact that with the further exception of the food and iron and steel industries, no report of other private generating plants was received is a clear indication of the efficient manner in which the central station is meeting the load requirements of California's industries. There is probably no other section of the country which can show such a mastery of the industrial situation by the central stations.

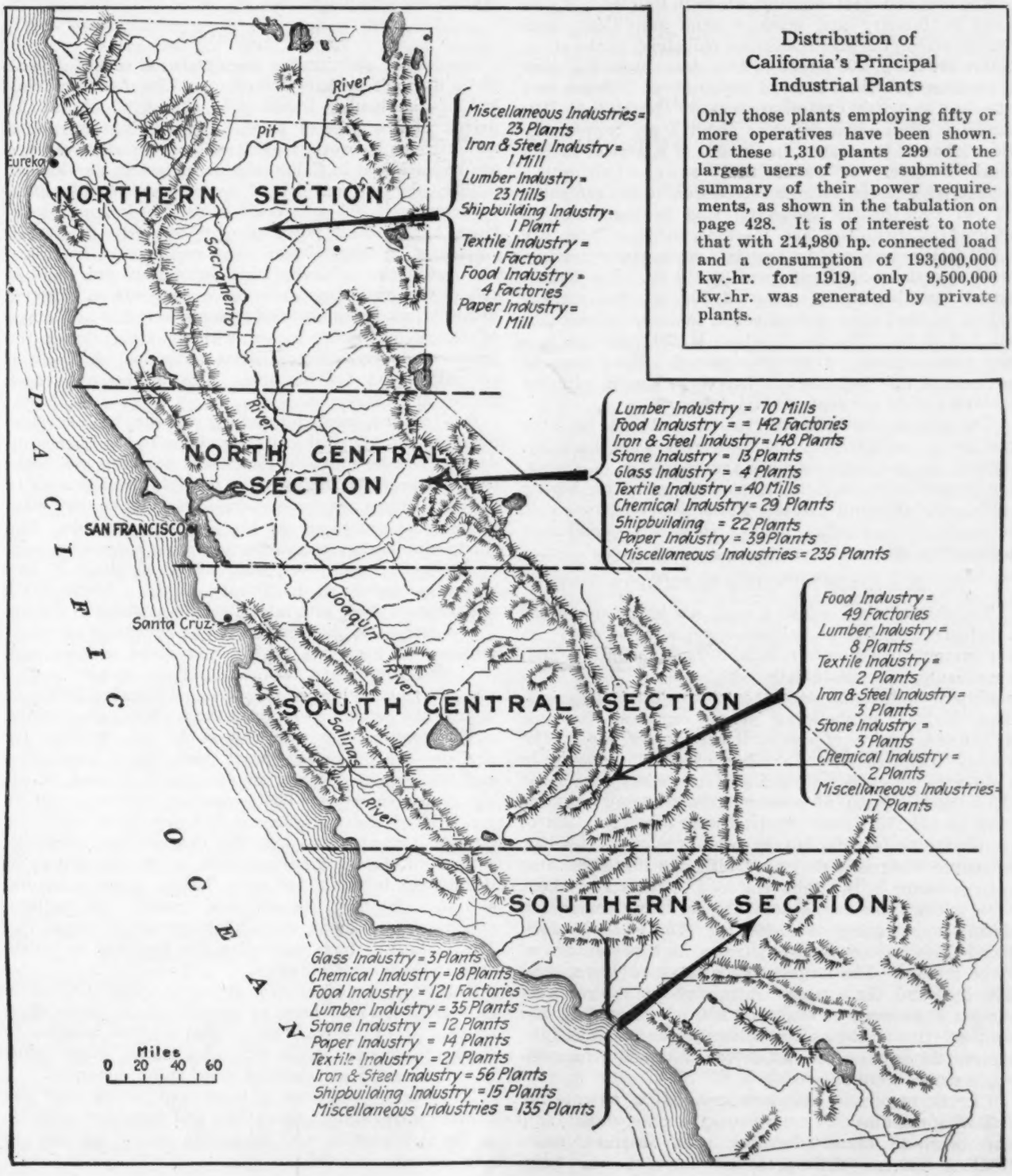
The food-preparation industry is the most important in California in value of products. This industry

SUMMARY OF INDUSTRIAL SURVEY OF CALIFORNIA AS OF JULY 1, 1920

Industry	Number of Companies Reporting	Water Wheels		Internal Combustion		Steam Engines		Steam Turbines		Electric Generators D. C.		Electric Generators A. C.		Energy		Motors Installed			No. of Drives		
		Number	Rating, Hp.	Number	Rating, Hp.	Number	Rating, Hp.	Number	Rating, Hp.	Number	Rating, Hp.	Number	Rating, Hp.	Generated, Kw.-Hr.	Purchased, Kw.-Hr.	Number	Rating, Hp.	Under 5 Hp.	Belt	Chain	Direct or Geared
Iron and steel	60	..	....	2	70	2	205	1	600	2	175	5	570	591,467	59,205,327	5,262	81,616	569	1,873	59	3,267
Motor trucks and accessories	11	..	....	..	....	..	....	..	....	..	....	..	....	.....	524,840	130	1,502.5	43	88	1	20
Textiles	23	..	....	..	....	1	55	..	....	3	21.5	..	....	.....	207,627	275	2,204½	70	151	27	83
Paper	9	1	300	..	....	3	637	..	....	1	65	..	....	.....	6,230,760	100	1,672½	25	58	..	10
Leather	8	..	....	..	....	..	....	..	....	..	....	..	....	.....	137,805	34	250	7	22	2	..
Food	96	..	....	4	1,200	58	5,382	9	2,320	32	1,610	14	3,498	4,386,080	16,867,864	2,207	32,968	784	1,946	137	599
Stone, clay and glass	10	..	....	1	20	4	220	..	....	..	....	..	....	.....	38,570,116	257	16,713	29	155	2	55
Mining	4	1	1,300	..	....	..	....	..	....	1	275	1	1,000	897,520	11,742,690	121	7,707	14	23	3	8
Shipbuilding	13	..	....	..	....	..	....	..	....	..	....	..	....	.....	41,116,484	1,941	46,099.5	360	516	14	1,285
Electrical equipment	3	..	....	..	....	..	....	..	....	..	....	..	....	.....	633,290	288	860	197	92	..	52
Lumber	39	..	....	..	....	37	11,020	13	5,988	11	*435.5	17	5,070	3,619,720	3,472,394	1,051	17,535.5	195	637	5	129
Chemicals	16	..	....	2	40	3	390	..	....	3	112.5	..	....	.....	4,314,732	392	6,624.5	81	269	14	62
Miscellaneous	7	..	....	..	....	..	....	..	....	..	....	..	....	.....	516,877	283	1,226.5	191	144	7	97
Totals	299	2	1,600	9	1,330	108	17,909	23	8,908	53	2,694.5	37	10,138	9,494,787	183,540,606	12,341	214,979½	2,565	5,974	271	5,667

* This is the total of only four of the direct-current generators.

includes the canning of fruits and vegetables, fish, oysters, clams, etc.; packing of dried fruits, the manufacture of pickles, jellies, preserves, sauces, etc.; wholesale slaughtering and meat packing and manufacture of sausage; flour-mill and grist-mill products; butter, cheese and condensed milk, and sugar manufacture. There are 316 plants of this general class in the state employing more than fifty operatives each, of which 45 per cent are in the north central part of the state. The reports received indicate that about 21 per cent of the electrical energy used in food-preparation factories is generated in private plants and that the amount of energy used in an average factory of this type is about 221,400 kw.-hr. per year. In the ninety-six factories reporting, 2,207 motors were installed with a total rating of 32,968 hp. Of the total number of motors 35 per cent are under 5 hp. The largest motor installed is rated at 500 hp., but the rating of the larger motors in a majority of the plants ranged from 25 hp. to 30 hp. The small motors range between ½ hp. and 1 hp. The usual voltage is 440 and 220, but two plants reported using voltage as high as 2,000. About 73 per cent of the machines are belt-driven, and 22 per cent are direct-connected or geared, the remainder being chain-driven.


Distribution of California's Principal Industrial Plants
Only those plants employing fifty or more operatives have been shown. Of these 1,310 plants 299 of the largest users of power submitted a summary of their power requirements, as shown in the tabulation on page 428. It is of interest to note that with 214,980 hp. connected load and a consumption of 193,000,000 kw.-hr. for 1919, only 9,500,000 kw.-hr. was generated by private plants.
NORTHERN SECTION
Miscellaneous Industries = 23 Plants
Iron & Steel Industry = 1 Mill
Lumber Industry = 23 Mills
Shipbuilding Industry = 1 Plant
Textile Industry = 1 Factory
Food Industry = 4 Factories
Paper Industry = 1 Mill
NORTH CENTRAL SECTION
Lumber Industry = 70 Mills
Food Industry = = 142 Factories
Iron & Steel Industry = 148 Plants
Stone Industry = 13 Plants
Glass Industry = 4 Plants
Textile Industry = 40 Mills
Chemical Industry = 29 Plants
Shipbuilding = 22 Plants
Paper Industry = 39 Plants
Miscellaneous Industries = 235 Plants
SOUTH CENTRAL SECTION
Food Industry = 49 Factories
Lumber Industry = 8 Plants
Textile Industry = 2 Plants
Iron & Steel Industry = 3 Plants
Stone Industry = 3 Plants
Chemical Industry = 2 Plants
Miscellaneous Industries = 17 Plants
SOUTHERN SECTION
Glass Industry = 3 Plants
Chemical Industry = 18 Plants
Food Industry = 121 Factories
Lumber Industry = 35 Plants
Stone Industry = 12 Plants
Paper Industry = 14 Plants
Textile Industry = 21 Plants
Iron & Steel Industry = 56 Plants
Shipbuilding Industry = 15 Plants
Miscellaneous Industries = 135 Plants
Eureka
Pit River
Sacramento River
San Francisco
Santa Cruz
Joaquin River
Salinas River
PACIFIC OCEAN
Miles
0 20 40 60

The uses of electrical energy in factories of this industry are many on account of the varied processes necessary in the manufacture of food products. Motors are used to operate pumps, cream separators, churns, bottle and can washers, refrigeration machinery, conveyors, elevators, beet slicers, preserving machinery, presses, grinders, sealing machines, blowers and compressors. The heating of water and milk and the operation of cookers, sterilizers and dryers is accomplished in many cases by electrical energy.

FOUNDRY AND MACHINE SHOPS

The iron and steel industry, which in California is confined to foundry and machine shop activities, ranks fourth among the manufacturing industries of the state. There are about 208 plants of this class employing more than fifty operatives each, of which about 71.2 per cent are in the north central section of the state. This industry gives employment to about 7 per cent of the total labor of the state. In amount of electrical energy used, however, it ranks first among California's industries, and the returns received indicate that about 31 per cent of the industrial load in that state is utilized by foundries and machine shops. There are 5,262 motors employed by the sixty companies reporting, with a total installed rating of 81,616 hp. The largest motor installed has a rating of 800 hp., the average rating of the larger motors being, however, between 15 hp. and 20 hp. The usual voltage is 220, although in a few cases voltage of 440 is reported. More than 63 per cent of the machines are directly connected with the motors, and 36 per cent are belt-driven.

The uses of the motor in the iron and steel industry are not so varied as in the food-preparation industry. Among the primary uses are the operation of cranes, air compressors, sand mills, planers, grinders, boring mills, straightening presses, fans, blowers, saws, drill presses, rolling mills, hoists, conveyors, sand-blast exhausters, etc.

ALL LARGE SHIPYARDS ELECTRIFIED

The shipbuilding industry could not be considered as a primary industry of California prior to the war. At the present time, however, it takes rank among the first. Practically all up-to-date shipbuilding yards are equipped throughout with the latest electrical devices. The thirteen shipbuilding plants reporting consume 41,116,484 kw.-hr. of electrical energy per year. The survey indicates that no other class of industry in California consumes so much electrical energy per plant with the exception of cement mills. During the war rush period the central stations were severely taxed to supply the demand for energy from shipyards. This has, of course, materially decreased, although it still remains a large factor in the industrial load of the state. About 1,941 motors are installed by the reporting companies, with a total rating of 46,100 hp. The class of work being done in shipyards requires a high percentage of large motors. The largest motor reported is rated at 500 hp., and the average rating of the larger-sized motors is between 280 hp. and 290 hp. About 71 per cent of the machines are directly connected to the motors, 28 per cent are belt-driven, while only fourteen chain drives were reported.

Electric motors in shipyards are used to operate the following machinery: Compressors, punches, shears, ship and overhead cranes, bending rolls, scarfers, angle benders, lathers, drill presses, pumps, boring bars, joiners, cut-off saws, shapers, pipe tools, winches, exhaust fans, bolt cutters, conveyors, marine railways, etc.

The adoption of electric drive in stone, clay and glass plants has been very general. One large cement mill reported an annual consumption of 20,866,970 kw.-hr. This plant uses more than 158 motors with a total installed rating of 7,478 hp. About 87 per cent of the machines in this plant are belt-driven, and 12 per cent are direct-connected. Electric motors are used to operate crushers, rollers, kilns, elevators, conveyors, sack-filling machines, shovels, compressors, pumps, cranes, screens, drills, etc,

LUMBER INDUSTRY

Lumbering and lumber manufactures constitute one of California's primary industries. The manufacturing end of the lumber industry is almost all electrically driven at the present time. The logging operations which could be worked electrically to great advantage are handicapped in California, or in fact in any lumber country, by the scarcity of power transmission lines.

Motors of 2,200 volts could be used in logging operations, but the high potential of 60,000 volts to 100,000 volts used in transmission lines would make necessary the installation of a portable substation and lines to follow the camps, as they move very often. Electric motor drives in woodworking plants have the advantage of decreasing the fire hazard, which is a big item in the lumber industry. Motors allow individual control and variable speed for machines such as hoists, veneer peelers and conveyors.

One of the most interesting of the late developments in the use of the electric motor in the lumber industry is to be found in electrically operated set works on carriages in sawmills. Two possible developments in the near future are the use of electric heat for dry kilns and magnetic steps on saw tables or clipper tables. The thirty-nine lumber companies reporting consume a total of 7,092,114 kw.-hr. per year, of which about 51 per cent was generated in private plants. About 1,051 motors were used, with a total rating of about 17,536 hp. The most widely used motor in the operation of woodworking machinery is the constant-speed squirrel-cage induction motor, and the usual voltage is 440 or 220. The few isolated lumber plants which installed 2200-volt motors are getting away from the high voltage rapidly.

The reasons for this change to low voltage are obvious—fire and safety hazard, high cost of installation and the greater damage to equipment in case of an electrical breakdown. The companies reported about 82 per cent of the machines as belt-driven, 17 per cent directly connected and only five chain-driven machines.

Some of the machines operated by electric motors in the lumber industry are saws, lathes, shapers, borers, elevators, jointers, blowers, drill presses, pipe cutters, punch presses, pumps, sorting lumber tables, cranes, etc. The storage-battery locomotive for trucking is widely used in the lumber industry.

The adoption of electric drive in other California industries has not been as general as in those cited above. It is possible, however, that a fuller response to the questionnaires would show that several other industries were adopting electrial drive quite generally.

The survey indicates a large and fertile field for future central station operations and furnishes evidence of the completeness with which the central stations are now covering the field.

Readers' Views and Comments

Rebuilding the Devastated Sections in France

To the Editor of the ELECTRICAL WORLD:

SIR: Why have not American contractors participated in the rebuilding of the devastated regions of France? There were predictions at the time of the armistice of great opportunities for them. Few of these opportunities have been realized. There are a number of reasons:

(1) The French want to rebuild according to French ideas, having regard also for the traditions of the ruined cities. These ideas are incompatible with the mass production proposed by some American contractors.

(2) The French have a pride in their ability to carry on construction. They resent the suggestion that they need help. There is, so far as I can learn, only one construction company here that represents American capital, and it is in reality a French company manned by French engineers and contractors. There are only three Americans in a responsible force of probably fifty.

(3) Construction can be taken in hand only so fast as the damages can be determined. This is an enormous task and necessarily can proceed only as rapidly as the relatively limited number of commissions of qualified men, familiar with local conditions, can work. With the fluctuations in wages and material prices, too, these damage credits are subject to frequent change. Under the law, an owner who rebuilds within 50 km. (31 miles) of the original site is paid the reproduction value as of the present date. Necessarily the estimate must be revised if wages and material costs change. A 20 per cent credit is granted as soon as the damages are determined, and other advances are made as the work proceeds. If an owner chooses not to rebuild, or to rebuild at a distant point, he receives damages based on values in 1914.

(4) The French government wisely decided to concentrate on work in the order of its economic importance: First, the reclamation of the land and the erection of temporary dwellings, then the restoration of the building-material industry, followed by the reconstruction of factories and the construction of permanent dwellings. The last feature has hardly yet been taken in hand. Therefore plans for rebuilding whole towns in permanent construction were not in order early in 1919 and are scarcely in order today.

(5) Building materials are scarce and must be distributed so that in all districts and towns progress may be at about the same rate.

There are other reasons, but these are the really important ones.

It is worth noting that the financing of work was not referred to until the question was raised by the visitor. In other words, the various factors above mentioned have always disposed of the American contractor before the question of finance was reached. The traditional position that all flows to the man with money did not hold here. Of course, France would still like to have American credits, but only to allow her to pay for raw material when the exchange has returned to normal or materially improved.

There is still much work to be done. In fact, only a beginning has been made, but the work is not likely to be done by American contractors. If they have capital to be employed, they may use it in France if they want to lose their identity and organize as a French company with French officials. Even then they will not get work, or succeed in what they get, unless they are willing to respect French customs and acquire some of that French tact to which we are largely strangers.

E. J. MEHREN.

Paris, France.

[E. J. Mehren, editor of the *Engineering News-Record*, one of the eleven McGraw-Hill publications, has just returned from Europe and reporting on engineering progress and opportunities there. This letter, containing some of his observations on conditions in the devastated sections of France, with special reference to the question of American participation in reconstruction, will interest readers of the ELECTRICAL WORLD.—EDITOR.]

Westinghouse Will Not Establish Mail-Order House

To the Editor of the ELECTRICAL WORLD:

SIR: I wish to call your attention to the fact that the note published in the ELECTRICAL WORLD of Aug. 21, p. 409, stating that the Westinghouse Electric & Manufacturing Company will establish a mail-order house for the distribution of small electrical equipment and supplies at Springfield, Mass., is incorrect as stated, since it implies that we propose to sell electrical household apparatus, etc., by mail, and this we have no intention of doing.

What we do propose to do here is as follows: We have quite a large business in supplying parts for the electrical starting, lighting and ignition equipment for automobiles, which we sell to our regular authorized dealers. As much of this business is by correspondence and practically all shipments are made by parcel post, we are arranging at Springfield, which will be the headquarters of our automobile equipment department, to organize this line of work in better shape than heretofore. This, as you can see, is not a mail-order business in the strict sense of the word, nor does it apply to any household line.

W. H. EASTON,
Publicity Department, Westinghouse Electric & Manufacturing Company, New York City.

Forestallers and Water Power

To the Editor of the ELECTRICAL WORLD:

SIR: First among the things to be avoided by the friends of water-power development are the wiles of "fake" promoters. One of the greatest nuisances in our complex modern civilization—as, indeed, he has been since time began—is the forestaller, he who, scenting a coming want, whether it be for theater tickets, fuel, foodstuffs, residences, building lots or public service franchises, gets in just ahead of the real purchaser or investor and extorts a totally unearned profit as his price for ceasing to obstruct the law of supply and demand. I am not, of course, referring to the legitimate middleman, but to the speculator whose sole idea is to buy cheap today and sell dear tomorrow and live in idleness on the double tribute he extorts. By all means let water-power sites be kept out of his clutches.

FRANK W. CHASE.

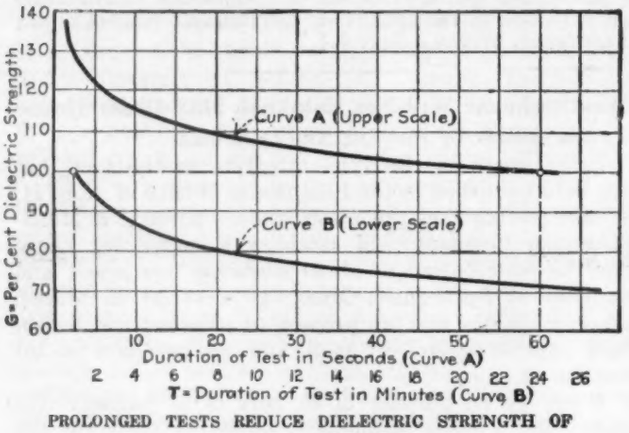
Brooklyn, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Reduction of Dielectric Strength by Testing

SOME operating engineers specify longer high-voltage tests than the standard period of one minute, perhaps without realizing the relative effect on the dielectric strength of the insulation being tested. For the benefit of such engineers data are given by the accompanying curve, which gives average values from tests of ordinary solid insulating materials. The tests were made at 60 cycles in oil at 75 deg. C. The curves may be expressed by the formula $G = 100 - 21 \log_{10} T$, where G is the present dielectric strength on the basis that insulation tested one minute has 100 per cent strength at the end of the test, and T is the duration of the test in minutes.



PROLONGED TESTS REDUCE DIELECTRIC STRENGTH OF INSULATING MATERIAL

Station Conduit Records Help in Making Alterations

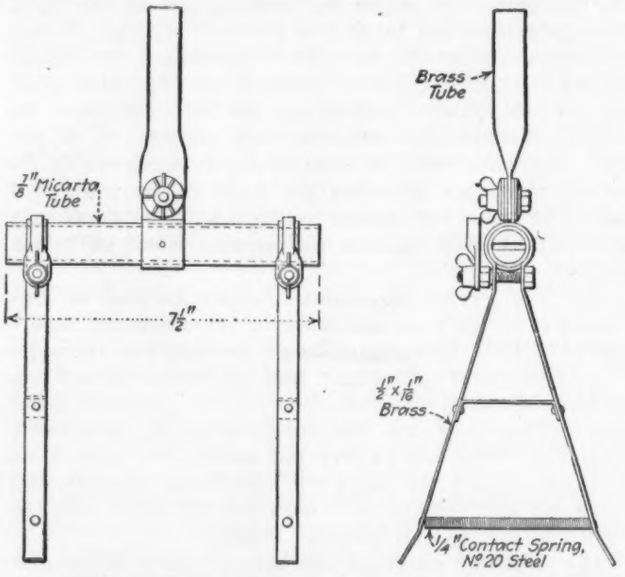
TO SAVE time and expense when making alterations in station wiring complete records of conduits and conductors prove very useful. In such records made by the Pennsylvania Water & Power Company a number is given to each pull box in the station and an arbitrary number to each conduit emerging in the pull box. A developed view of the pull box with each one of its conduits, showing exactly its location and number, is framed and mounted on a wall close to the pull box. A duplicate record is kept in the office. It is a practice in some stations to tag or mark cables in pull boxes, but it has been this company's experience that there is no satisfactory system of doing this. One trouble is that the tags are liable to be wrongly replaced when alterations are made. For this reason the cables are identified by means of the location of the conduits from which they emerge. A list is made up of every circuit in the station, on which are recorded the purchasing data for the cable and a record of the number of each pull box and each conduit that it goes through from its origin to its destination.

Such records should be made while the station is being built, and they should be changed if necessary with each alteration. The justification of going to the expense of completely recording conduits and circuits in a station already constructed depends upon how badly confused or crowded the conduit system is and on the frequency of alterations. Such an expense is seldom warranted.

ALEX. BAUHAN.
Pennsylvania Water & Power Company,
Baltimore, Md.

A Megger Fork That Facilitates Testing Line Insulators

FOR meggering suspension-type insulators in place the fork shown here, devised by the Southern California Edison Company, is very satisfactory. As such a fork often receives rough handling in the field, even being dropped from the top of towers, it must be practically unbreakable. This form consists of a $\frac{7}{8}$-in. (2.2-cm.) tube of $\frac{1}{16}$-in. (1.5-mm.) micarta and is about $7\frac{1}{2}$ in. (19 cm.) long. Near the ends of this tube are fastened forks of $\frac{1}{2}$-in. x $\frac{1}{16}$-in. (13-mm. x 1.6-mm.) brass clamped on the micarta tube and spaced apart by a flat brass separator. Between the ends of each fork is attached a contact spring $\frac{1}{4}$ in. (6 mm.) in diameter and 4 in. (10 cm.) long. When in use one of these springs rests on the cap of the insulator while the other rests on the



ADJUSTABLE JOINT AND SPRING CONTACTS OF THIS MEGGER FORK MAKE IT EASY TO TEST INSULATORS ON THE LINE

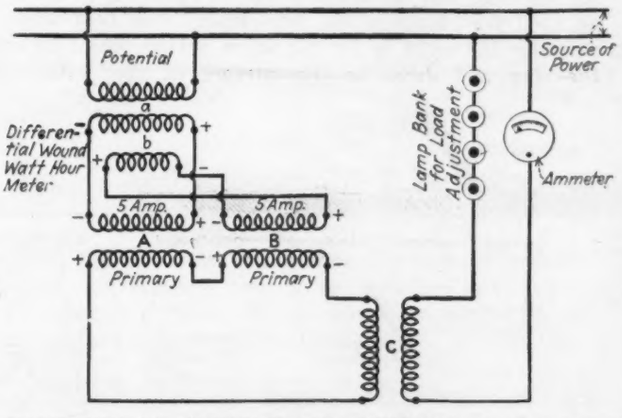
stud. At the center of the tube, by means of an adjustable joint, is attached a brass tube into which a ferrule on the end of a bamboo rod may be inserted. This rod is made up in 5-ft. (1.5-m.) sections for easy carrying. By use of the adjustable joint, which is attached by a wing nut, the fork may be turned to any desired angle for testing. Application to the insulators is very easy as the springs do not require that the fork be held steadily in one place. The lead wires are inserted in two lugs attached to the forks. In order to avoid creepage over the cloth insulation on the lead wires, which are of extra heavy lamp cord, the cloth is skinned back about 2 in. (5 cm.) from the end of the wire, leaving the rubber insulation exposed.

W. R. BATTEY,
Chief Electrical Designer.
Southern California Edison Company,
Los Angeles, Cal.

Differentially Wound Watt-Hour Meter for Testing Current Transformers

FOR quickly adjusting the turns on current transformers a differentially wound watt-hour meter has been used successfully by a Western central station for several years. This differential winding consists of two current coils wound on the same core. These are connected to the transformer to be tested and to the standard transformer, while the same current is passed through the primary side of both transformers. If the disk rotates in either direction, the transformer ratios are not the same; but if the disk remains still, the ratios are identical.

The watt-hour meter employed for this test is a rebuilt single-phase integrating meter of standard make. In order to obtain maximum sensitiveness the moving element was mounted on the best jeweled bearings obtainable. The 5-amp. current winding was removed and replaced by a double winding of the same number of turns for each winding. For this double winding two conductors of the same size, but insulated from each other, were wound side by side and transposed on every layer. The wires were bound tight together and were separated only when well outside of the magnetic path. The original 110-volt potential winding was retained, but the starting coil was removed. In order to test out the instrument the potential winding was excited and the two coils of the differential winding were connected in opposition while current from zero to 5 amp. was circulated through them. Under these conditions the disk remained stationary, showing that the coils were evenly balanced.



CONNECTION TO DIFFERENTIALLY WOUND WATT-HOUR METER FOR TESTING CURRENT TRANSFORMERS

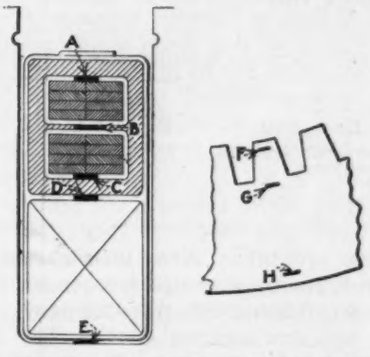
A — Standard current transformer. B — Current transformer under test. C—Stepdown transformer supplying current for primary sides of *A* and *B*, *a* and *b* are parallel coils wound on same core in watt-hour meter.

The principal use of this meter is in adjusting the number of turns on the current transformers. When the transformer has the correct number of turns adding one turn causes the meter to revolve in one direction and removing one turn reverses the meter. Very quick work is done.

E. C. WESCOTT.
Sacramento, Cal.

Distribution of Heat in Windings and Core of Generators

BY MEASUREMENTS with embedded temperature detectors the temperatures in the different parts of generators have been found to be as indicated in the accompanying illustration. It is seen from this diagram that the hottest point in the conductor is in the upper coil, or the coil nearest the open end of the slot, while the hottest temperature in the iron was, at normal voltage of the machine, at the base of the tooth, and, at 11 per cent voltage, at the extremity of the tooth.



POINTS WHERE TEMPERATURE READINGS WERE TAKEN

This difference in temperature between the two coils is principally due to the difference in eddy-current loss arising from the cyclic change of leakage flux. The eddy loss in the top coil is lower if the throw of the coils in a particular slot is such as to increase the phase angle between the current in the two coils.

These tests indicated that the thermal drop through the insulation in large, long-core, high-voltage, 60-cycle machines is of the order of 50 deg. C. Moreover, all heat must flow transversely through the insulation. The thermal drop in the insulation in such machines cannot be appreciably lowered by changing the design of the ventilation.

These data were taken from a paper read by F. D. Newbury and C. J. Fechheimer before the recent meeting of the American Institute of Electrical Engineers.

LOCATION OF THERMOCOUPLES IN 12,000-KVA. ALTERNATOR TESTS, AND RELATIVE READINGS AT TWO VOLTAGES

Coil Position*	6,600 Volts, 960 Amp.			No. of Detector	7,260 Volts, 960 Amp.		
	Max.	Min.	Av.		Max.	Min.	Av.
A	78.3	71.3	74.1	6	91.3	84.3	86.8
B	77.0	70.3	73.0	6	89.0	74.7	84.0
C	72.6	66.5	69.5	6	84.0	78.6	81.4
D^1	64.0	52.9	56.9	12	69.0	57.0	63.3
D^2	58.7	43.5	51.5	5	63.5	56.5	60.7
E	54.0	42.8	47.9	6	66.3	54.2	60.1
F	48.0	44.3	46.3	3	60.5	53.4	56.6
G	49.0	40.4	45.0	3	58.3	47.1	52.3
H	45.1	40.5	43.0	3	53.8	50.5	52.2

*D^1—single-slot cell; D^2—double-slot cell.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Effective Light in Offices

THE light falling on the desks in offices is dependent upon the color of the walls and ceilings, therefore it is very essential that these be light in color—white or slightly cream-colored—to insure maximum efficiency of reflection. The accompanying table gives the approximate percentage of light from the lamps which may be expected to reach the desks under different conditions in rooms of average size, *i.e.*, about 20 ft. x 20 ft. (6 m. x 6 m.) using various types of lighting fixtures.

PERCENTAGE OF LIGHT REACHING DESKS

Types of Lighting	Light Ceiling		Medium Ceiling	
	Light Walls	Medium Walls	Light Walls	Medium Walls
Prismatic glass direct	60	53	52	48
Opalescent glass direct	50	45	44	42
Totally indirect	32	30	23	20
Semi-direct	38	34	28	24

The data are taken from information supplied by A. L. Powell, lighting service department of the Edison Lamp Works, General Electric Company.

Short Arc Is Necessary for Successful Welding

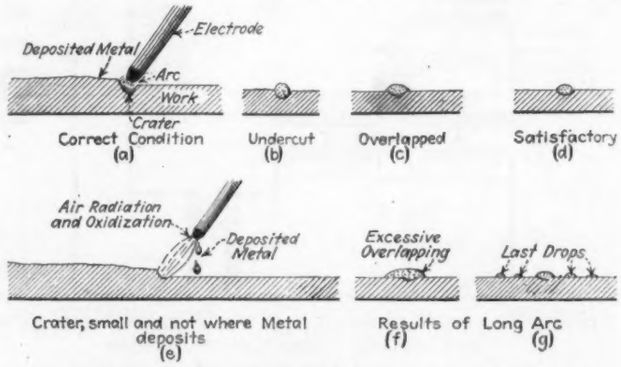
A SHORT arc held at the advancing edge of the puddle is the secret of successful electric arc welding. The natural tendency is to draw a long arc, but in this case too much of the heat is lost by air radiation, there is too great an area for oxidation of the metal in passing from the electrode to the work, and there is too great an area provided for the air to get in and form oxide and nitride, both of which are very undesirable impurities in the weld. There is a further chance with a long arc that the electrode material will not be deposited in the parent metal made fluid by the arc, but will be spattered outside or overlapping, in which case no weld results.

The electrode material must pass into the crater or fluid bowl made by the arc, and the electrode must be held in such a position that the metal can pass nowhere but into this fluid bowl. The fluid bowl appears only at the point the arc strikes, and the arc must be kept striking just ahead of the deposited metal, partially in the parent metal. If the arc is allowed to draw back on the bead, simply a bridge of metal welded from the weld to the point where the arc next strikes the parent metal will result. With flux-coated wire with the bare side advancing (the correct position) the flux coating will follow along, combining the molten puddle and preventing the arc backing up on the weld, provided that a close arc is held.

To get the correct rate of heat for any given condition of electrodes or work the following test should be applied: Run a bead and note whether the edges are undercut as at *B*, overlapped as at *C* or perfect as at *D*.

If they are slightly undercut, it can be told by looking at the bead, but the perfect weld and the overlapped weld can be told only by chipping off the bead. Different electrodes melt at different rates of heat, and different kinds of parent metals show small and larger fluid bowls or craters, depending on their make-up, so that even with the correct length of arc this test should be applied for each new condition. The undercut in general results from a bowl larger than the electrode deposited to fill it, and the overlap bead may result from too small a bowl or from a long arc. With an arc over $\frac{1}{2}$ in. (1.2 cm.) long, and with certain current densities, the bowl may disappear entirely, showing results as at *F*, *G* and *E*, which also show how the results indicated may be had.

With the completely coated electrode the arc exists inside of a viscous tube deposited at the same rate as the electrode, the idea being to keep the oxygen and nitrogen of the air from combining with the steel when molten and when it has its greatest chemical affinity. With this electrode a slag is left around and on top of the weld which must be chipped off from a clean start if the arc should happen to go out or in restarting to continue the bead. With the flux-coated electrode, bare side advancing, there is no danger of slag inclusion. As the slag can be brushed off in restarting, there is no need for chipping the arc clean. The best way of cleaning the weld is by the same action which brings the slag and dross to the surface of the weld with this electrode. With bare wire there is naturally no danger of slag inclusion, but a continuous amount of the oxide and nitride of the iron is included as the time for bringing them to the surface is too short to allow them to disentangle.

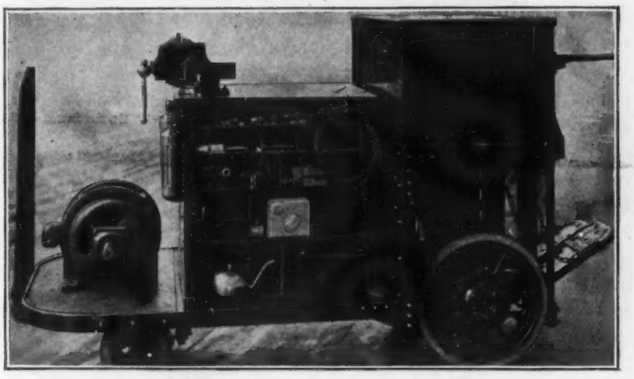


CORRECT METHODS AND INCORRECT METHODS OF ARC WELDING

C. J. HOLSLAG.
Electric Arc Cutting & Welding Company,
Newark, N. J.

Motor-Repair Trouble Wagon

TO REDUCE the periods of shutdown a portable repair wagon for maintenance of the motors and other electrical apparatus has been developed in a Detroit factory having 700 motors in operation and designed for an ultimate installation of 1,000 motors. In case any motor trouble develops or is indicated the foreman of the department calls the wagon by pushing the button on any pillar, thus operating an annunciator in the repair shop. The wagon, which is a modified industrial truck



A MOTOR-REPAIR SHOP ON WHEELS

This repair wagon is equipped with virtually everything necessary to correct the troubles usually found in motors, controllers, lamps, wiring and conduit. A trouble call brings the repair wagon to most parts of the plant in a minute or less.

painted red to compel attention and secure right of way, is equipped with a bench, a vise and everything that experience has shown to be necessary to making quick repairs to motors. With two or three exceptions the motors used in the plant are only up to about 15 hp. in size, and if a motor has to be removed there is a platform on the truck on which the motor or compensator or both can be carried back to the repair department and a new motor brought to the job.

The extent of the plant is roughly 600 ft. x 360 ft. (180 m. x 110 m.), but the truck can get to the farthest point one minute and a half after it has been called. There are always men in the repair department, so if the truck is out when a call comes some one goes on foot.

Detroit, Mich. Central Gear Company.

Double-Acting Solenoid Which Has Strong Pull

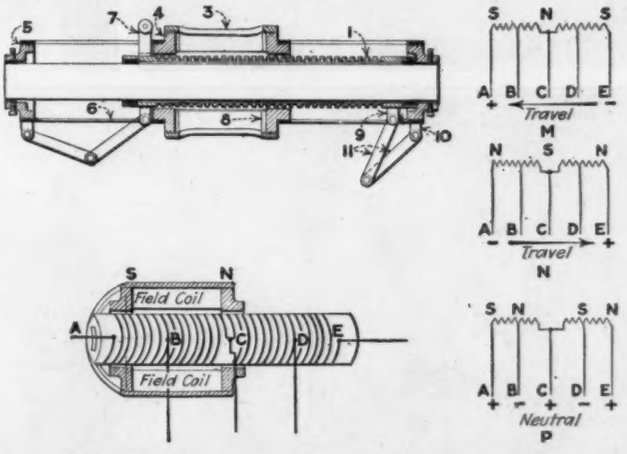
A SOLENOID which is double-acting and at the same time will attain a neutral position has been developed to operate a duplex friction clutch on a head frame of the United Zinc Smelting Corporation, Moundsville, W. Va.

This device pulls equally well in either direction with a nearly uniform pull throughout its travel, and a very long travel may easily be obtained. Moreover, in moving to its neutral it develops a pull equal to the forward or reverse pull and does not appreciably overtravel the neutral position. The solenoid consists principally of a field coil inside of which moves a hollow plunger around which is a specially divided winding. This plunger has grooves upon its surface in which the coils are wound. From the center to the right end the winding is left-handed, and from the center to the left end the winding is right-handed. The length of the winding in the grooves is twice the length of the field coil. The operation of the solenoid is as follows: The field coil is entirely surrounded by an iron inclosing cylinder and the end pieces of the cylinder are also of iron.

Therefore, when this coil is excited a magnetic flux is set up through the cylinder end pieces, and the sliding armature. The hollow armature slides upon a guide of iron which increases the flux. Referring to the perspective sketch shown here, when the current is sent from *A* through to *E*, the armature will tend to move to the left until the right-hand end of the armature is underneath the end of the field coil. The reason for this is that the current in the left end of the armature runs in one direction while that in the right end runs in the other direction owing to the reversal of the winding at the point *C*. This causes a north pole at the left end of the armature and a south pole at the right end.

These poles tend to get under opposite poles of the field coil and hence move the armature in a left-hand direction. To reverse the direction the current is reversed in the armature. In order to make the armature assume its neutral position current is massed as indicated in *P*. This makes a north pole at *B* and a south pole at *C*, which move the center of the armature directly to the center of the field coil. Connection with the different parts of the coil is made by means of flexible wire fastened to the links (11) as shown in the accompanying drawing.

It will be noted that the principle of the action of the machine, for which patents have been asked, corresponds to that of a direct-current motor. For this reason the travel is slow compared with the solid plunger solenoid. This is due to the counter-emf., generated by the moving plunger, which reduces the current and the pull as the speed increases. By making the housing long enough the plunger will overtravel and a counter-force produced by the reverse winding coming under the field coil will stop the plunger before it strikes the end fram-



THIS SOLENOID OPERATES IN EITHER DIRECTION OR ASSUMES A NEUTRAL POSITION

ing. On a test of a solenoid of this type with a 3-in. (7.5-cm.) plunger, ¾ in. (2.25 mm.) thick and 15 in. (37.5 cm.) long with a consumption of 500 watts to 600 watts, a pull of 40 lb. (18 kg.) developed with a 6-in. (15-cm.) stroke. J. W. MURRAY.

United Zinc Smelting Corporation,
Moundville, W. Va.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Electrical Home Idea Promotes Electric Service in California

AS A MEANS of educating the public to a greater use of electric service model electrical homes are rapidly proving their value throughout California. These homes are being demonstrated and advertised by the California Electrical Co-operative Campaign in collaboration with leading real estate firms which have taken hold of the idea with enthusiasm.

The California Electrical Co-operative Campaign staged the first of these homes in San Francisco, with the combined assistance of the Mason-McDuffie Company real estate dealers, and electrical interests of the community. The Pacific Gas & Electric Company shared in planning and carrying out the exhibit and demonstrations, providing energy free of charge. An attractive house under course of construction in the St. Francis Wood district of San Francisco was chosen for the demonstration. The house was readily adaptable to the "convenience-outlet" idea, and the amount of wiring was trebled. Convenience outlets were increased from the five or six originally planned to thirty-six. Incidentally these were found insufficient, and in the later homes the number is being increased. Scenes in the various rooms of the electrical home are shown in the accompanying cuts. Approximately 18,000 people visited the house during the two weeks it was open to the public.

So successful was this experiment from the stand-

VIEWS OF SAN FRANCISCO'S ELECTRICAL HOME. MEN OF THE ELECTRICAL INDUSTRY CONDUCTED VISITORS THROUGH THE HOUSE AND EXPLAINED THE VALUE OF CONVENIENCE OUTLETS. EIGHTEEN THOUSAND PEOPLE VISITED THE HOME AND IT WAS OFTEN NECESSARY FOR THEM TO WAIT IN LINE TO GAIN ADMITTANCE, AS SHOWN IN THE UPPER LEFT

TWO PAGES OF SUNDAY NEWSPAPER SUPPLEMENT DEVOTED TO THE ELECTRICAL HOME IN SACRAMENTO

point of the electrical industry and the real estate firm alike that similar arrangements have been made for other California cities. The California Electrical Co-operative Campaign has already opened electric homes in Sacramento and Oakland and others are under way in Los Angeles, San Diego, Fresno, Bakersfield, Long Beach, Stockton and Berkeley. It is planned to establish, all told, eleven of the homes in the larger cities of California and to complete the campaign by Dec. 1 in order to secure the maximum effect on the Christmas shopping.

Advertising Methods

The home was advertised in the newspapers, in the street cars and by billboards, as well as direct by mail advertising. This latter consisted of invitations sent to clubs and to individuals to attend the demonstration. The cost of this advertising was borne jointly by the real estate firm and by the electrical industry of San Francisco. In response to the publicity thus given the installation, the house was continually crowded. Clubs attended in a body on many occasions, classes were taken over to see the home from the University summer school and hundreds of individuals made their way out to satisfy their own interest. Conductors on street cars leading to this district needed only to be asked for directions to the "Electrical Home" to answer with exactly the information wanted.

It is estimated that more than 200,000 persons will visit electrical homes in California before the first of the year, and about $14,000 will be spent in advertising them. Two-thirds of the expense will be carried by the real estate firms. This is distinct from the advertising which appears over the names of electrical dealers and power companies and the generous follow-up by the real estate people after the campaign is over.

An advertising feature of the program at Sacramento was a four-page supplement devoted to electrical advertising and reading matter in one of the Sunday papers. Two pages of this supplement are reproduced here. In these pages were the advertisements of thirteen electric contractors and dealers, one real estate firm, one house-furnishing store and one electric player-piano company.

The program of these campaigns has been arranged so that the advertising appears in newspapers with a large circulation outside of their respective cities, and thus by the time all the electrical homes have been advertised the state will have been covered twice.

More Electrical Homes to Be Built

More important than the large numbers of visitors at the San Francisco and Sacramento homes is the announcement by one real estate company that all its residences are to be built as electrical homes in the future. It is also reported that 150 homes now under construction in Oakland will be wired for electric ranges, and in Chico two houses are being built the wiring for each of which will cost more than $1,000.

While the electrical home idea is not new, the first electric house having been equipped by William J. Hammer in Newark, N. J., in 1884, and while "houses electric" have been successfully conducted from time to time by central stations in the East and South, particularly in Chattanooga, Tenn., and Brooklyn and Elmira, N. Y., the California Electrical Co-operative Campaign has succeeded in linking the idea with the needs of the times. Through its co-operative policy the interests of the electrical industry and real estate companies have been joined in a mutually profitable undertaking. From the standpoint of the central station this movement is providing, at a comparatively small cost, a much-needed campaign for the education of the public in the possibilities and proper use of household electrical devices.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Temperatures in Large Alternating-Current Generators.—W. J. FOSTER.—The writer calls attention to certain advantages that would result from reversing the common practice of ventilating the large generators in hydro-electric units. That is, it is proposed to take the air in directly from the room, piping it away to some point in the building remote from the machines or out of doors. This is a simpler scheme and results in a more comfortable temperature in the room in hot weather.—*General Electric Review*, July, 1920.

Lamps and Lighting

Lighting of Schools.—A. L. POWELL.—The problem of lighting school buildings is discussed and appropriate schemes of lighting for blackboards and other problems peculiar to school buildings are passed in review.—*Bulletin L. D. 109, Edison Lamp Works*, May, 1920.

Motor-Car Headlights and Rear Lights in Relation to Traffic Requirements.—J. W. T. WALSH.—A discussion of means to prevent the dazzling effect of automobile headlights and the use of headlights that are too powerful. Favorable reference is made to the American practice, particularly to regulations in the codes of New York and Connecticut.—*Illuminating Engineer*, April, 1920.

110-Volt Versus 220-Volt Circuits from the Standpoint of Lighting Service.—F. J. GRAY and E. B. FOX.—Although there would be some saving in copper by the use of 220 volts instead of 110 volts for lighting service, it is shown that the lamps manufactured for 220 volts are more expensive and less satisfactory, causing a much higher renewal cost than those for 110 volts. The excessive annual cost entailed by the use of high-voltage lamps more than offsets the saving in copper investment.—*Bulletin L. D. 105, Edison Lamp Works*, April, 1920.

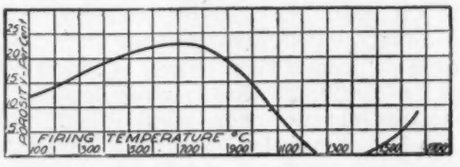
Generation, Transmission and Distribution

Electric Power for Mining.—F. S. VIELE.—Details are given of a 12,000-hp. hydro-electric plant and a steam plant of 10,000 hp. capacity for the supply of a mining load in Arizona. It is said that practically every mining operation in the vicinity is operated electrically by customers taking from 50 hp. to 5,000 hp. The system is that of the Arizona Power Company.—*Journal of Electricity*, July 15, 1920.

The Design of Distributing Networks.—C. A. GILLIN.—The writer deals with the fundamentals of distribution network design, considering the possible use of higher voltages than those commonly employed whether the system shall be underground or overhead and the standardization of substations.—London *Electrician*, July 2, 1920.

Stoker Furnace for Coal or Oil.—The design and installation of an oil-burning system in one of the plants of the Erie Forge & Steel Company is such that it takes only about twelve hours to make a change from one fuel to the other, depending upon whether the fuel supply is coal or oil.—*Power Plant Engineering*, Aug. 1, 1920.

Factors Controlling the Design and Selection of Suspension Insulators.—W. D. A. PEASLEE.—A discussion of the factors entering into the design and operating behavior of suspension insulators and the problems to be solved in designing a suspension insulator to overcome the objectionable features shown by experience to affect seriously the operation of the insulators in service. Factors to be taken into consideration in the selection of suspension insulators for a given condition are set forth and a brief discussion of the general trend of future improvements is presented. An interesting curve is given showing the relation between the firing



INFLUENCE OF FIRING TEMPERATURE OF PORCELAIN

temperature and porosity for one porcelain body, indicating that non-porous porcelain may be obtained when the firing temperature is between about 1,250 deg. and 1,450 deg. C.—*Journal A. I. E. E.*, June, 1920.

Traction

The Italian State Railway Electrification System.—A. BARBAGELATA.—An anaysis of the discussion of June, 1919, on the question of the system of electrification on the Italian State Railways. The author summarizes the economic superiority of the high-tension continuous-current system and calls for immediate application of this system to a group of important lines in central Italy pending the completion of the three-phase electrification of the Ligurian-Lombardy-Piedmontese railways.—*Technical Review*, July 20, 1920. (Abstracted from *L'Elettrotecnica*, Feb. 5 and 15, 1920.)

Regulation and Inductive Effects in Single-Phase Railway Circuits.—A. W. COPLEY.—Methods of calculating regulation are followed by an interesting study of inductive effects on communication circuits. In planning for an electrification which is paralleled by telephone and telegraph circuits, the writer states, it is essential that induction be taken into account from the start. The introduction of special devices into either the telegraph or the railway circuits is annoying and sometimes quite expensive. By carefully laying out the

transformer stations and determining the probable induced voltages beforehand, however, very little extra expense should be involved and a system can be obtained which is free from most of the extra devices. If the stations are so laid out that the short-circuit conditions on the railroad do not cause dangerous voltages in the telephone lines, normal operating conditions will as a general rule take care of themselves. If after all reasonable steps have been taken in the railroad circuit, the induced voltage is still above the working limits and yet does not cause a physical hazard, the use of some such device in the resonant shunt in the telegraph lines will probably take care of whatever voltage remains. If there is a short distance where the exposure is very severe, and the spacing of transformer stations to take care of this condition would be so close as to cause considerable expense, such a short stretch could be protected by some of the special devices considered above without affecting the rest of the system. In an appendix the writer shows how impedances of the trolley circuits may be calculated and also describes various arrangements of resonant shunts for use in special instances.—*Electric Journal*, August, 1920.

Installations, Systems and Appliances

A Fuel-Oil Installation.—H. A. WILCOX.—It is said that one of three boiler rooms of an old plant was equipped for oil burning to increase the steaming capacity without additional boilers. At the same time a costly method of coal handling was eliminated.—*Power Plant Engineering*, May 15, 1920.

Automatic Control of Arc Furnace Electrodes.—J. A. SEEDE.—The writer deals with that class of furnaces of the arc type in which control of the power input is obtained by moving the electrode up or down or in or out, as the case may be. How this automatic control is carried out is described for six different arrangements of electrodes. Advantages of automatic control over hand control are given by the author as follows: (1) Power input; (2) furnace maintenance; (3) electrode consumption; (4) labor charges; (5) quality of product; (6) upkeep of transformers.—*Journal, A.I.E.E.*, June, 1920.

The Largest Rolling Mill in the World.—This is a 42-in. (1.7-m.) plate mill of the reversing type, which can deal with slabs up to 7 ft. by 4.5 ft. by 1.5 ft. (2.1 m. by 1.37 m. by 0.46 m.), weighing 10 tons. Plates are turned out at the rate of 60 tons per hour for two hours and 30 tons for the remaining period of the shift. The motor is a double-unit machine with the units connected in series, the midpoint being at earth potential. The continuous rating of the motor is 6,750 hp. at 40 r.p.m., 1,600 volts, and a peak load capacity of 20,500 hp. at the same voltage and speed. The speed can be further increased up to 70 r.p.m. by weakening the motor field. Oscillographic tests show that this motor is capable of being reversed from 40 r.p.m. in one direction to 40 r.p.m. in the opposite direction in less than three seconds. The control for this motor is given in considerable detail.—London *Electrician*, May 7 and 14, 1920.

Methods That Will Make Electrical Parts of Mine Locomotives Run Efficiently.—A discussion of the possibilities of failure in motors, resistors, storage batteries and trolley arms of mine locomotives and the proper steps to be taken to prevent them and repair such defects as they appear.—*Coal Age*, July 29, 1920.

The Electric Lighting of Railroad Signals.—L. C. PORTER and F. S. STALLKNECHT.—It is pointed out that the electric lighting of railroad signals is both cheaper and more reliable than older methods using oil lamps. Although in some instances the installation of electrical equipment is more costly than that for the oil lamp, this first cost is soon wiped out by economy of operation over the period of a year or so.—*Transactions I. E. S.*, June 10, 1920.

Electrophysics and Magnetism

Measurement of Hysteresis Values from High Magnetizing Forces.—W. L. CHENEY.—After reviewing former attempts to measure hysteresis values with apparatus of a modified "isthmus" type and discussing possible causes for errors in observation, an improved method for measuring hysteresis values by means of this apparatus is described. The results agree, within the experimental error, with those obtained on standard types of apparatus. Observations, carried as high as $H = 2{,}500$ gausses, are shown graphically.—*Scientific Paper No. 383, Bureau of Standards*, June 19, 1920.

Spectro-photoelectric Sensitivity of Thalophide.—W. W. COBLENTZ.—Experimental data are given on the spectro-photoelectric sensitivity of Case's preparation of thallium-oxysulphide, called thalophide when exposed to thermal radiation of wave lengths extending from 0.58μ to 3μ. This substance has a wide, unsymmetrical, complex band of photoelectric sensitivity which terminates abruptly at 1.2μ. The effect of temperature was also investigated. It was found that, in common with nearly all photoelectric substances thus far examined, the sensitivity increases most rapidly on the short wave length.—*Scientific Paper No. 380, U. S. Bureau of Standards*, June 17, 1920.

Telegraphy, Telephony and Signals

The Alexanderson Continuous-Wave System.—This is a description of the high-power radio apparatus for radio-telegraph and radio-telephone transmission at New Brunswick, N. J. The New Brunswick station, which is typical of a 200-kw. Alexanderson installation, consists of three important developments: (1) An alternator, which generates currents directly at the frequencies required for the radio circuits with which it is associated. The frequency of these currents is solely dependent upon the number of field poles on the machine and upon the speed at which the rotating member is driven. This is in distinct contrast to certain other systems in which the radio-frequency currents are obtained indirectly by means of "reflector" circuits or frequency-raising transformers electrically associated with the alternator. (2) A magnetic amplifier, which provides a non-arcing control of the alternator output for radio-telegraphy and is equally applicable to radio-telephony. (3) A multiple tuned antenna, a development which has markedly reduced the wasteful resistance of the flat-top antenna and has therefore increased the transmitter over-all efficiency manyfold.—*Wireless Age*, July and August, 1920.

Miscellaneous

The Electrically Welded Ship Fullagar.—The Fullagar is an entirely welded ship. The success on this ship has shown that welding is effective for all purposes in such work. It is not claimed that it is necessarily the cheapest method. The ship is one of 25,000 cu.ft. (700 cu.m.) displacement.—London *Engineering*, July 2, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

PESSIMISM in the South, induced by a rainy spell, and complants of ruinous freight rates by the lumber interests of the Northwest, are offset to some degree by hopeful reports from the Intermountain states and improved transportation conditions East and South. Sales are still light and collections are reported as slow and difficult except on the Pacific Coast, where they are fairly prompt.

A RECENT drop in the price of cotton has not affected the prices of electrical goods containing this material, though cotton insulating tape and webbing have declined.

EVIDENCE of a growing market for American electrical household appliances abroad continues to accumulate, official returns showing more than 100 per cent increase in exports of these articles for 1919 as compared with 1918.

A MARKED scarcity of insulating paper is reported on account chiefly of the difficulty in obtaining necessary raw materials, but manufacturers are hopeful of an early improvement.

DELIVERIES of bare copper wire are impeded by fuel and car shortage, and stocks have been interfered with by the great demand for the insulated product, which has led to the conversion of much bare wire that would ordinarily have found its way to the dealers.

ORGANIZATION of the engineering staff of the super-power zone survey between Boston and Washington has been announced by the chairman, W. S. Murray. Wide publicity for the project is favored by its engineering staff.

PATENT licenses covering wireless telegraphy and telephony are to be exchanged by the American Telephone & Telegraph Company and the General Electric Company.

RAILROADS have been prohibited by the Interstate Commerce Commission from refusing coal cars to utilities because the latter have surplus coal on hand. The coal supply of New York City utilities continues to show a slight improvement.

RETURNS issued by the Geological Survey for the month of May show a total electrical output by central stations, electric railways and certain other plants of more than 3,500,000,000 kw.-hr., of which about 1,500,000,000 kw.-hr. was generated by water. These plants consumed nearly 16,000,000 tons of coal in the first five months of the year.

WORK has been begun by the San Joaquin Light & Power Company on its first 17,500-hp. unit in its new steam plant in the Kern County oil fields. The unit will burn 7,000,000 cu.ft. of gas a day and will be in operation next summer; estimated cost, $1,750,000. Four other units are planned.

WORCESTER, Mass., will have an electrical show in Mechanics' Hall, the largest auditorium in the city, Sept. 20-25.

A STATEMENT of principles covering rental charge, amortization of reserves, depreciation of reserves and allocation of earnings is being worked out by the Federal Power Commission.

RIGID economy in power consumption in view of the present acute shortage has been ordered by Power Administrator Butler of California.

FOR COMPLETION of its Caribou project by the addition of 20,000 kw. the Great Western Power Company has issued $3,500,000 in 8 per cent ten-year bonds.

A RADIO station with a radius of 12,000 miles, built by the United States Navy, has been put into operation at Bordeaux, France.

DIFFERENCE of opinion on the commercial value of the proposed Great Falls development on the Potomac was brought out before the Federal Power Commission.

THE "ELECTRICAL home" idea in California now includes seven houses completely equipped with convenience outlets. The seventh home will be in Long Beach and will be opened to the public Oct. 15.

A PROPOSAL that electrical contractors shall be required to have licenses from the city as well as from the state is included in the revised electrical code of Seattle, now under discussion.

ALREADY the largest membership reached by any American engineering body has been obtained by the Federated American Engineering Societies.

EIGHT important meetings of electrical associations are scheduled for the month of September.

AN ISSUE of $1,000,000 of 8 per cent ten-year bonds has been made by the Pacific Power & Light Company at 98.25, to yield 8¼ per cent.

THE JULY statement of the Southern California Edison Company shows an increase of 51 per cent in gross income over the corresponding month last year.

REFRACTORIES will be the topic discussed at the meeting of the Electric Furnace Association at Columbus, Ohio, on Oct. 6.

GAS-FILLED incandescent lamps are to replace gasoline lamps in St. Louis parks and are to be installed on isolated streets.

HYDRO-ELECTRIC engineers in New England report increasing interest among manufacturing establishments and bankers in plans for building new installations of moderate size and improving existing plants.

FURTHER expansion of the Lynn works of the General Electric Company depends in large measure upon the production record of the employees, according to a press statement by Manager R. H. Rice announcing the removal of the greater part of the small-motors department to the Bridgeport (Conn.) plant.

RECOGNITION has been granted to the Michigan central stations by the appointment of a representative of the Consumers' Power Company on the Coal Committee named by the Governor of the state.

OPPOSITION on the part of a citizens' organization to fixing an 8 per cent rate of return for the Potomac Electric Power Company was expressed at a hearing before the Public Utilities Commission of the District of Columbia.

APPLICATION has been made by the Connecticut River Company to the Federal Power Commission for permission to build a 40,000-hp. hydroelectric development, including dam and locks, on the Connecticut River at Windsor Locks, Conn.

A RESOLUTION favoring action by the Ohio Electric Light Association and its member companies to expedite the work of the Ohio Public Utilities Commission has been passed by the executive committee of the body first named.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

American T. & T. and General Electric to Exchange Wireless Patents

PATENT licenses covering wireless telegraphy and wireless telephony are to be exchanged by the American Telephone & Telegraph Company and the General Electric Company under the terms of a contract which was announced this week. Negotiations which led up to this contract were begun after each company had received letters from the Bureau of Steam Engineering of the United States Navy in which the bureau gave the opinion that the interests of all would be served best by some agreement between the holders of permanent patents.

H. B. Thayer, president of the American Telephone & Telegraph Company, in announcing the agreement, stated that under the exchange of patent licenses provided for in the contract the General Electric Company and the Radio Corporation of America, in which the General Electric Company has become interested, would be able to further the development of wireless communication and the American Telephone Company would be able to supplant its wire extensions.

"The world-wide wireless system of the Radio Corporation and the universal service of the Bell System," said Mr. Thayer, "are thus brought into a harmonious relation that will facilitate the use by the public of the present wireless-telegraph facilities of the Radio Corporation and, as the art advances, will enable the American Telephone & Telegraph Company to extend its telephone service to ships at sea and to foreign countries."

In order better to carry out the purpose of the agreement the American Telephone & Telegraph Company has purchased a minority interest in the Radio Corporation of America. W. S. Gifford, vice-president of the American Telephone & Telegraph Company, has been made a director in the Radio Corporation of America.

Railroads Shall Not Refuse Coal Cars to Utilities with a Surplus

AN INTERPRETATION of paragraph 4 of Service Order No. 9 has been given by Commissioner Clyde B. Aitchison of the Interstate Commerce Commission in a letter written by him to the public utilities of Maine, which states that such coal as may be accumulated by public utilities under the regular car supply "should not be used by the railroads as a means of reducing the number of cars that the public utilities may otherwise be able to secure for current needs under Order No. 9."

The occasion for this interpretation was the refusal of certain railroads to give priority assignment of coal cars to public utilities having on hand a supply of coal which the railroad agents considered to be in excess of their current needs. In these refusals the railroads had previously been upheld by the commission. It was shown that if such a ruling held good, any company having more than a day-to-day supply of coal would be unable to obtain cars under Order No. 9. The commission, after considering the matter from this viewpoint, issued the foregoing interpretation. Public utilities, therefore, may insist upon assignment of cars for coal sufficient to take care of their current needs and at the same time lay up a surplus supply of coal if they are able to secure it from any other source.

The coal situation among the utilities of the New England States is intense, and many of them will be hard put to it to supply their needs through the coming fall and winter.

Orders to investigate repeated resales of coal have been issued by the Attorney-General to every district attorney in the United States.

Coal Supply of New York Utilities Continues to Show Slight Improvement

ON AUG. 24 the total coal on hand and in reserve by the public utilities of New York City, as reported by the Public Service Commission, was 309,910 tons. This is an increase of 36,597 tons over the previous week. The public utilities are, however, still nearly 200,000 tons below the stocks they should have in reserve at this time of year. In normal times to pass through the winter with a safe margin the companies should have on hand about 500,000 tons by Sept. 1 and 800,000 tons by Oct. 1.

Great Falls Development Discussed Before Federal Power Commission

GREAT difference of opinion exists as to the commercial feasibility of the development of Great Falls, on the Potomac. This was clearly shown at a hearing on this project which took place before the Federal Power Commission on Aug. 24. Representatives of the Potomac Electric Power Company, the large steam plant of which furnishes most of the power for the District of Columbia and vicinity, opposed the project, S. R. Bowen, vice-president of the company, telling of adverse reports his company has received from engineers. He admitted that, while it had acquired power rights at the Falls sixteen years ago, his company has no present plan for the utilization of the water power.

Col. Charles W. Kutz, the Engineer Commissioner of the District of Columbia, testified that the development of the Great Falls project would be justified even if it were necessary to maintain existing charges. This contention was based on the advantages which would come from the diversion to other uses of the coal now required to operate the steam plant.

Federal Power Commission Holds Special Hearings

IN VIEW of the great importance which private interests are attaching to the exact language of the water-power act regulations the Federal Power Commission has held special hearings this week. Attention was concentrated on a statement of principles. Once an agreement is reached on the principles involved, it is believed that the final language can be worked out more leisurely. The principal points to be covered by the statement of principles are rental charge, amortization of reserves, depreciation of reserves and allocation of earnings. The scheme of development, construction and maintenance of project works has practically been completed by a committee consisting of Herman Stabler, R. R. Randall and O. G. Thurlow.

The Comptroller of the Treasury has ruled that the specific appropriation of $25,000 carried in the act may be expended for field service. In a former ruling the Comptroller held that no portion of the $100,000 appropriation could be used for the hiring of personnel.

R. R. Randall has been appointed an assistant engineer on the staff of the commission. Mr. Randall has been in immediate charge of water-power matters for the Forest Service. F. W. Griffith, formerly chief clerk of the Bureau of National Parks, has been appointed chief clerk for the commission.

Michigan Section, N. E. L. A., Discusses Utility Problems and Rural Service

THE public needs to attain a correct understanding of the meaning of commission regulation and to be convinced that it is a partner in public utility affairs and is hit directly when utilities are not fairly treated. This was the substance of the address of W. M. Smith, chairman of the Michigan Public Utilities Commission, before the convention of the Michigan Section of the National Electric Light Association, which opened at the Ottawa Beach Hotel, Ottawa Beach, Mich., on Tuesday of this week. The public's feeling that its interests and those of the utilities are not mutual must be done away with, Mr. Smith declared.

President Martin Insull and M. H. Aylesworth, executive manager of the N. E. L. A., told the convention of the significance of the new organization of that association and its ability to aid in the upbuilding of the industry.

In an address on "Home Rule Versus State Control," delivered at the Wednesday session, W. J. Hagenah of Chicago emphasized the impossibility of a municipality building up a specialized organization competent to deal with utility regulation problems. No one municipality has a large enough number of problems to keep such an organization employed, and in addition it would be too near the source of controversy to be impartial.

That electric power service is to be a vital factor in the work of the farmer was asserted by Prof. A. R. Sawyer of the Michigan Agricultural College in a paper on "Standardization of Electric Farm Line Equipment," in which the situation was discussed from the standpoint of the farms as well as the central stations.

The program during the Tuesday and Wednesday sessions included papers on electric meter maintenance, boiler-room efficiency, and the electric dishwasher, and also an account of the work of the Illinois Committee on Public Utility Information. The session extended over Thursday, on which day the subjects of machine billing and ledger posting and the value of statistics were discussed. J. B. Wooten of New York delivered an address on publicity at the banquet Wednesday evening. Lawn parties Tuesday and Wednesday afternoon were provided for the entertainment of those present, special entertainment for the ladies also being arranged.

Indiana Electric Light Association Announces Program

THE program for the convention of the Indiana Electric Light Association, to be held on Wednesday and Thursday, Sept. 15 and 16, has been announced as follows:

WEDNESDAY, SEPT. 15

President's address; committee reports; address, "Future of Electric Light and Power Companies," by Martin Insull, president N. E. L. A.; address by E. I. Lewis, chairman of the Indiana Public Service Commission; address, "Future of Public Utilities," by Charles C. Perry, president Indianapolis Light & Heat Company.

THURSDAY, SEPT. 16 (COMMERCIAL SECTION DAY)

Address, "Voluntary Versus Involuntary Co-operation," by William L. Goodwin, General Electric Company; address, "Central Stations and Contractors," by Samuel Adams Chase, Westinghouse Electric & Manufacturing Company; paper, "Industrial Application of Electric Power-Factor Correction and Its Effect," by T. F. English, general manager Indiana General Service Company; paper, "Reduced Operating Expenses Versus Increased Fixed Charges," by George A. Neal, Northern Indiana Gas & Electric Company; round-table discussion; election of officers.

Electrical Meetings in September

EIGHT important electrical associations will hold conventions in the month of September this year—four in the East, two in the Middle West, one in Colorado and one on the Pacific Coast. The dates and meeting places are as follows:

Sept. 8 to 11—Bedford Springs, Pa.; Pennsylvania Electric Association.

Sept. 8 to 11—Spokane, Wash.; Northwest Geographic Division, N. E. L. A.

Sept. 8 to 9—Omaha, Neb.; Nebraska Section, N. E. L. A.

Sept. 13 to 15—Glenwood Springs, Col.; Colorado Electric Light, Power and Railway Association and Rocky Mountain Geographic Division, N. E. L. A.

Sept. 13 to 16—New London, Conn.; Association of Edison Illuminating Companies.

Sept. 14 to 16—Kineo, Me.; New England Geographic Division, N. E. L. A.

Sept. 15 to 17—French Lick, Ind.; Indiana Electric Light Association.

Sept. 20 to 24—New York City; Association of Iron and Steel Electrical Engineers.

Programs of the Northwest, Nebraska and Colorado meetings were printed in the ELECTRICAL WORLD for Aug. 21, page 398; for the Edison company, Illuminating Engineering Society and New England meetings on Aug. 14, pages 349 and 350, and for the Iron and Steel association on Aug. 7, page 300.

In addition to the above meetings, the Telephone Pioneers of America will meet in Montreal on Sept. 10 and 11 and the American Electrochemical Society will convene in Cleveland on Sept. 30, continuing its meeting through Oct. 1 and Oct. 2.

Federated American Engineering Societies Largest Engineering Body

IN A bulletin just issued by the joint conference committee of the four founder societies, it is pointed out that there is a tendency when discussing the Federated American Engineering Societies to refer to it as a "proposed" organization. Attention is called to the fact that the Federated American Engineering Societies is in actual existence with a membership already that makes it the largest engineering organization in this country. This membership includes the American Society of Mechanical Engineers, Detroit Engineering Society, Technical Club of Dallas and American Institute of Electrical Engineers. Official action on the part of many other organizations is all that is necessary to complete their standing as regularly enrolled members.

Manufacturers Should Build "Customer-Partnership" with Utilities

AS THE business of electrical manufacturers is largely dependent upon the welfare of central stations and other public utilities, the manufacturers can materially assist through their national advertising in building good will for the utilities. Recognizing the value of this idea to the entire industry, J. M. Wakeman, general manager of the Society for Electrical Development, is advocating that electrical manufacturers devote their space for some time to this extremely important object. In discussing the matter with a representative of the ELECTRICAL WORLD Mr. Wakeman pointed out that this is a self-interest idea and could result only in profit to the manufacturers. He said:

"The manufacturers are having difficulty in filling orders which they have on their books, and those who have contracted for space in the popular magazines should use that space in behalf of the central stations and should so word their advertisements to appeal for the moral and financial support of the communities served by the central stations. Taking up the broad question of soliciting the support of the community, the main object is to build up a bulwark against Bolshevistic ideas, particularly along the lines of municipal ownership of public utilities, substituting the idea of 'customer-partnership' as opposed to that of municipal ownership.

"Our idea is that the manufacturers can well afford to devote their space to building up good will for the utilities in the minds of the people by pointing out how the self-interest of the community lies in the prosperity of the public utility."

Tennessee Contractors and Dealers Meet Next Week

NASHVILLE will be the meeting place of the Tennessee Association of Electrical Contractors and Dealers Saturday next, Sept. 4, when two sessions will be held at the Tulane Hotel. Governor Roberts will speak on public utilities commission topics and the following addresses will be made and discussed: "First Aid to Public Utilities," by J. P. Lawrence, Nashville; "Selling Appliances on Term Payments," by W. H. Synans, Nashville; "Comparison of Profits in Electrical and Hardware Trades," by H. G. Street, Memphis; "Proper Handling of Fixture Sales," by P. W. Curtis, Chattanooga; "Tennessee License Law," by W. R. Herstein, Memphis; "Conducting a Retail Store," by J. A. Fowler, Memphis; "Electrical Advertising." by E. S. Dunham, Memphis; "Window Display," by J. A. Corcoran, Schenectady, N. Y.; "The Mazda Lamp," by O. G. Heinke, Nashville, and "Fall and Winter Business Outlook," by C. R. Wright, Knoxville.

The Nashville Electric League will give a dinner to the delegates in the evening, when an address on "Harmonizing the Industry" will be made by a speaker not yet announced.

Refractories to Be Discussed by Electric Furnace Association

THE subject of "Refractories" has been selected for the session of the Electric Furnace Association which will be held at the Ohio State University, Columbus, on Wednesday afternoon, Oct. 6. The meeting will provide an opportunity for a discussion of their problems by the users and makers of refractories. Papers will be presented by steel men and by the manufacturers of bricks and lining materials, and considerable time will be allowed for questions and informal discussions by the delegates present.

Western Construction Engineer Substitutes Aeroplane for Automobile

REX C. STARR, the young construction engineer who broke all records in carrying through the Kerckhoff project of the San Joaquin Light & Power Corporation, has begun to use a 185-hp. biplane to decrease the time taken in covering by automobile the hundreds of miles of valley and rough mountain roads separating the various jobs under his supervision. This photograph shows him arriving at Auberry on the morning of Aug. 15 for the starting of the power house. Mr. Starr left Fresno at 8:30 a. m. and was in Auberry, 20 miles distant, in twenty-five minutes. His machine is piloted by Shirley Bush, a former army flier. The San Joaquin Light & Power Corporation has prepared a landing field at its headquarters camp at Auberry and also one at Crane Valley, 10 miles further in the mountains. Other fields will be prepared on the Kings River project and near the company's Kern River plant. Mr. Starr is probably the first hydro-electric construction engineer to make use of the aeroplane. He has already been flying between Fresno and San Francisco.

A. S. M. E. to Discuss Valuation

AT THE annual meeting of the American Society of Mechanical Engineers, which will be held in the Engineering Societies Building, New York City, from Dec. 7 through Dec 10, special sessions will be held on the subjects of appraisal and valuation and the application of engineering to woodworking. A committee will be appointed to review the society's work in the past covering valuation and appraisal of industrial and public utility plants and recommend subjects for discussion at the coming meetings.

California Co-operative Campaign Plans Lighting Exhibits

TWO committees of the California Electrical Co-operative Campaign, one in Los Angeles and the other in San Francisco, are completing plans to place in operation in those cities, in October, exhibits for the purpose of stimulating better industrial lighting. These plans follow the success of the industrial lighting exhibit made at the National Electric Light Association convention at Pasadena this year, where much interest was aroused in this scheme.

Specifications for Rural-Line Construction in Wisconsin

THE Railroad Commission of Wisconsin is preparing specifications covering rural-line construction. The growth of rural service in Wisconsin has been so rapid that the need of rules that will insure substantial construction and at the same time keep the original investment to the lowest possible figure is keenly felt. The rules under which rural extensions are made in the state provide for the financing of the lines by the customers. The commission is interested in seeing that future troubles due to inadequate construction or unnecessary construction costs are avoided. It is expected that the inductive interference problem will receive consideration as it is particularly important in rural work where ground-return telephone lines are common.

Electric Lighting Replaces Gasoline Park Lamps in St. Louis

THE city of St. Louis is installing about 3,400 80-cp. and 100-cp. gas-filled incandescent street lamps to replace the gasoline street lights which have been used in the city parks and to illuminate some isolated streets which are not now illuminated. Approximately 3,000 of the lamps will be connected to 6.6-amp. series circuits and the remainder will be 110-volt multiple units. The lamp posts are being made from crushed Missouri granite, and the circuits will require the installation of about 178 miles of underground cable.

Mobridge (S. D.) Hydro Project to Be Considered Next Spring

SUBMISSION of the Mobridge hydro-electric project, recently reported on by Mead & Seastone, to the voters of South Dakota will probably be made at the regular election next spring. This project involves building a dam in the Missouri River and foreshadows a possible ultimate output of 85,000,000 kw.-hr. (see ELECTRICAL WORLD, June 12, page 1390). There has been some sentiment favoring submission this fall, but more conservative counsels have prevailed and the submission has been deferred until next spring to give full opportunity for discussion both in official circles and among the people of the state. It is said that the consulting engineers have, because of the unusual nature of the project and its importance in the development of the state, expressed a desire for a check of their report by an independent investigator.

Central Stations Recognized in the Michigan Fuel Committee

THE public utilities of Michigan have been recognized in the formation of the Michigan Coal Committee by the appointment of B. E. Morrow, manager production and transmission department of the Consumers' Power Company, Jackson, as a member. Gov. Albert E. Sleeper has appointed the following committee: Chairman, W. K. Prudden, president Prudden Wheel Company, Lansing, former fuel administrator; E. J. Dubois, fuel commissioner of Detroit Board of Commerce; Charles B. Kelsey, utility engineer, Grand Rapids; C. H. Benedict, Calumet & Hecla Copper Company, Lake Linden, and B. E. Morrow, Consumers' Power Company. The committee are now engaged in securing a definite report of fuel stocks in the state and will include in the report full information as to contracts and orders for fuel as well as amounts of coal being shipped at this time on orders and contract. The committee will take steps to assist Michigan fuel users to prevent interruption to their operations.

Anticipated Power Shortage in California Now Being Felt

"CENTRAL and northern California are now entering upon the acute period of the electric power shortage, owing principally to the lack of rains in the past winter and the present heat, which has dried up the rivers to the lowest stages known. It will be necessary for a 15 per cent cut to be made upon cement mills, gold dredgers and street railways at once. The supply of electric energy for power, except for domestic use, for growing crops and for handling perishable foods, must be reduced 20 per cent." This was the information sent out by H. G. Butler, power administrator of the California Railroad Commission, in a telegram to all the power companies in California calling for a meeting at his office at once. He further stated that "other industries will be restricted similarly as fast as the necessary steps can be taken. Street, sign and display lighting must be cut to the minimum consistent with safety."

"The steam plants of the California companies are operating at their maximum capacity," Mr. Butler continued, "and the smaller plants of consumers, wherever available for use, have been put into operation to reduce the demand upon the larger companies. Notwithstanding this, the demand for electric power at the present time largely exceeds the supply, and it is becoming necessary to place further restrictions upon the users of electricity where it can be done without excessive loss or damage, in order that there may be sufficient power to avoid loss of crops and to provide for the absolute needs of the other industries."

New Edison Medal Committee of A. I. E. E.

AT THE recent meeting of the board of directors of the American Institute of Electrical Engineers, the board, in accordance with the bylaws of the Edison medal committee, confirmed the appointment by President Berresford of Comfort A. Adams, chairman engineering division, National Research Committee, New York, as chairman of the committee, and of H. M. Byllesby, president H. M. Byllesby & Company, Chicago, D. E. Drake, sales engineer Westinghouse Electric & Manufacturing Company, New York, and W. L. R. Emmet, consulting engineer General Electric Company, Schenectady, N. Y., as members of the committee for terms of five years each. The board also elected three of its own membership as members of the Edison medal committee for terms of two years, namely, W. I. Slichter, Columbia University, New York; L. E. Imlay, operating engineer Niagara Falls Power Company, New York, and F. D. Newbury, division engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

New Financing by Pacific Power & Light Company

THE Pacific Power & Light Company, with main offices at Portland, Ore., has issued $1,000,000 of 8 per cent ten-year bonds to mature in 1930. They are secured by a mortgage on the company's property and business, subject to its present mortgage, and also by deposit of a like amount of the company's bonds issued under the present mortgage.

The bonds were purchased by N. W. Langley & Company of New York and are being handled locally by Blythe, Witter & Company, the Ladd & Tilton Bank, Freeman, Smith & Camp, Lumberman's Trust Company and E. L. Devereaux & Company. The price is $98.25, to yield the investor 8¼ per cent. Half a million dollars of the money is to be used to take care of the company's present floating indebtedness for improvements, and the other half million dollars is to pay for the new steam electric generating station at Astoria. It is understood that this money cost the company in the neighborhood of 10 per cent.

The company is awaiting decision by the Public Service Commission of Washington on its application for an increase in its electric rates in that state. If this be granted, it will materially help in the marketing of the bonds and the raising of additional money in the future for needed extensions and improvements.

Powerful Radio Station Put in Service in France

WHAT is described as the most powerful radio station in the world, with a sending radius of 12,000 miles (19,000 km.), was put in service at Bordeaux, France, last Saturday. This great sending radius is obtained by the use of very high-power arc transmission equipment and eight antenna towers 820 ft. (250 m.) high. Tests show that the audibility of signals from this station is about five times as great as from the Nauen station in Germany.

The first message sent out from Bordeaux, called the Lafayette station, was readily received at Washington and Bar Harbor, Me. It was said to be the first radio message sent around the world, because it should be possible to get messages 12,000 miles each way from the Lafayette station. This station was started during the war and built by the United States Navy, but it is to be turned over to the French government as soon as the tests now being conducted are completed.

Functions of International Bureau May Be Increased

CONSIDERATION is to be given to the matter of increasing the functions of the International Bureau of Weights and Measures when that body meets at Paris in September. It has been suggested that the bureau shall have the custody of numerous other standards than those of weights and measures, and it has also been recommended that the bureau arrange to investigate and promulgate constants of materials or physical values which at the present time are based solely upon private investigation. This would lead to international agreement through some sort of convention entered into by scientists in different countries as to the values to be used in engineering and scientific work similar to the agreement and general practice with respect to the value for gravity (G).

The suggested change has been considered with a large degree of favor by members of the American Physical Society, the National Academy of Science and the National Research Council. Dr. S. W. Stratton, director of the Bureau of Standards, will be the principal representative of the United States at the Paris meeting.

Wide Publicity Advocated by Engineering Staff of Super-Power Survey

THE desirability of wide publicity in forwarding the plans of the super-power survey was recognized at a recent meeting of the engineering staff connected with the project. James H. McGraw, whom W. S. Murray, chairman of the Super-Power Committee, asked to take charge of this part of the committee's work, suggested that the Editorial Conference of the Technical Press, on which between twenty-five and thirty papers are represented, would form the best medium through which to work. Mr. McGraw also pledged the services of the McGraw-Hill Company, with its eleven engineering journals.

The area to be included in the survey was discussed, and it was decided to include the water powers of the St. Lawrence and those in New England as far east as the Kennebec River in Maine. The southern boundary is to be the Potomac River and the western boundary will be the eastern slope of the Appalachian Mountains.

Chairman Murray expressed himself as favoring the appointment of a second member of the National Electric Light Association on the advisory board and said that he had asked the N. E. L. A. to make this appointment.

Reports from the division engineers were asked for, and L. E. Imlay of the power and transmission division of the survey, Henry W. Butler of the industries division and Cary T. Hutchinson of the railways division told of what they had so far accomplished, a suggestive discussion following.

The next meeting will be held on Monday, Aug. 30.

Safety Code Rules to Which Exception Is Taken by the N. E. L. A.

IN THE forthcoming edition of the National Electrical Safety Code the Bureau of Standards has expressed its willingness to designate those rules to which exception has been taken by the National Electric Light Association and other interests that have carefully studied the rules and are qualified to judge of their reasonableness. The objections raised and the reasons of the bureau for not changing the rules to avoid these objections will also be included.

Recent correspondence between the Bureau of Standards and the National Electric Light Association on the code will be of interest to readers of the ELECTRICAL WORLD. Through the courtesy of the *N. E. L. A. Bulletin* this correspondence is reproduced in full:

DEPARTMENT OF COMMERCE, BUREAU OF STANDARDS,
WASHINGTON, July 7, 1920.

National Electric Light Association, New York City:
GENTLEMEN:

1. Supplementary lists of changes to the 1916 edition of the National Electrical Safety Code were circulated in May and, as a result of the comments received, the bureau has endeavored by further modification to meet the objections which were raised and finally to frame the rules so as to be reasonable and proper to the vast majority of our conferees. We believe this has been successfully accomplished with respect to Section 9 and Parts 1 and 3. We have not, however, been able to meet all of the suggestions made with respect to Part 2, regarding which there seemed to be some irreconcilable difference of opinion.

2. One of the principal points which have delayed the new edition and regarding which there has not been general agreement is the loading specification for transverse loading. This has been simplified in form and modified numerically, but the apparent increase in requirements for grades B and C is largely balanced by modifications made for selected poles and for averaging poles. The aim has been to improve the form of the specification rather than to call for stronger or safer construction, and we believe the revised rules represent good modern practice better than the 1916 code.

3. We inclose herewith a final list of changes which will modify the lithograph copies and supplementary lists of changes already in your hands. We trust these additional changes will make the text of the new edition of the safety code satisfactory to you. In case there are important items remaining which you think have not been satisfactorily disposed of, we should be glad to have a statement from you mentioning such items and suggesting in what respects and for what reasons they are unsatisfactory and what action you would recommend to make them satisfactory. May we have a prompt reply? Respectfully,

S. W. STRATTON,
Director.

NATIONAL ELECTRIC LIGHT ASSOCIATION,
NEW YORK, July 19, 1920.

Dr. S. W. Stratton, Director Bureau of Standards, Washington:

MY DEAR SIR: We have just received your letter of July 7, together with supplementary list of changes to the 1916 edition of the National Electrical Safety Code, and believe that these changes are all in the direction of increasing the workability and reasonableness of the rules.

In response to your inquiry as to the general satisfactoriness of the National Electrical Safety Code rules as now revised for their third edition, we are glad to confirm our previous statements that, broadly and so far as information brought together permits accurate judgment, we believe that the great majority of the rules will not cause widespread hardship and will meet the real need for a workable national safety standard for electrical construction. We wish to commend the very sincere effort of the bureau to insure that no undue hardship shall be caused any interest affected and realize that this has involved considerable adjustment in the various trial requirements set up in previous editions of the code.

In some respects, comparatively few in number, it is our conviction that such information as is available warrants nationally less severe requirements than now proposed for the 1920 code. Probably the most important case of this kind is the proposed requirements for stronger construction of supply lines above 2,900 volts to ground than below that voltage limit. The 1916 code required this stronger construction only for supply lines above 5,000 volts between wires. We believe that the test data available support this proposed change to the extent that voltage to ground is made the criterion in the proposed rule rather than voltage between wires as formerly. We are, however, equally of the belief that the data show clearly that there is no warrant, even assuming the continuance of the present common type of telephone protector, for placing the dividing point below 5,000 volts to ground. On the basis of the data available it would appear that any change to be made in voltage limit for the 1920 edition should be upward. Certainly, before any change downward is made in the voltage limit the question of employing better telephone protectors should, we believe, be impartially investigated as an evidently cheaper means for maintaining safety than the requiring of serious increases in pole and conductor costs for the pole lines of light and power companies where voltages to ground exceed some unnecessarily low limit. Possibly there is still time to adjust this voltage limitation in the several rules so as to "make the penalty fit the crime."

In some other respects, also few in number, we are of the conviction that available data are still clearly insufficient on which to base actual mandatory requirements, though no doubt sufficient to justify the setting up or continuance of bogie requirements, such as those of 1916, avowedly for trial use. Probably the best examples of such rules are the transverse pole-line strength rules, No. 2, and the rules for oil-filled apparatus, No. 1. The intent in the latter rules, as proposed for 1920, is clearly to offer a suggested practice, and we believe this is the correct intent, pending further information which it may take some time to procure through the committees at work. The former rules as we read them in the proposed 1920 edition have no similar modifying statements to continue them on the same trial basis as applied to their counterparts in the 1916 edition. Information which we believe is essential before these (or any other transverse strength) rules become mandatory in effect should include ascertainment of the existence of pole-line failure where poles are various percentages under the proposed strength requirements; further study into the accuracy with which the proposed classification of degree of hazard and requirements in various situations measures their actual relative hazards; also further studies into the changes in the pole supply situation during the last nine or ten years, since the pole purchase classifications were prepared by the National Electric Light Association. This pole supply situation has been affected by local deforestation, transportation difficulties and increased expense in various communities and actual shortage of some kinds and sizes of timber formerly readily available. There would also be considered in this study as to what extent it is practical to make better distribution of poles along pole lines, according to the growth of loads, than has been the case hitherto. Tests would also be conducted to show to what degree increasing total weight for number of conductors carried affects the increase of load and the supporting of any one pole by the nearby poles in a tangent line.

Such studies, in our conviction, have by no means been carried far enough, and we feel that the changes developed by the bureau as a result of its interpretation of the partial data so far obtained on some existing lines should, if substituted for the former rules recognized as for trial use, be clearly designated as for trial application only. They would then represent a trial practice whose suitability as a standard could then be more maturely tested in the light of this

further study, and modified as found advisable in the public interest, before being expressed in mandatory form. This would apparently not only protect the industry against undue severity of requirement but would protect the bureau against the possibility of proposing as mandatory requirements which have not yet been subjected to the test of experience as fully as have other parts of the code and which may impose inequitable burdens on the industry.

We wish to congratulate the bureau on its success thus far in the difficult task of bringing all interests together to co-operate in the development of a national code, and we desire to continue most actively in the work. We hope that through our newly formed engineering department we may be able to make our co-operation more effective and more fully representative of all parts of the country and all phases of experience than has been found possible in the past.

We understand that a mention of our co-operation and objection to a few outstanding features of the code will be made by the bureau in its introduction to the third edition, and we should be very glad to have the opportunity of noting the manner in which our statement is summarized and discussed by the bureau.

We should also be glad to know to what degree the code is now satisfactory to the other interests concerned and in what respects and for what reasons any items continue to be unsatisfactory to them. Very truly yours,

W. J. CANADA,
Engineer.

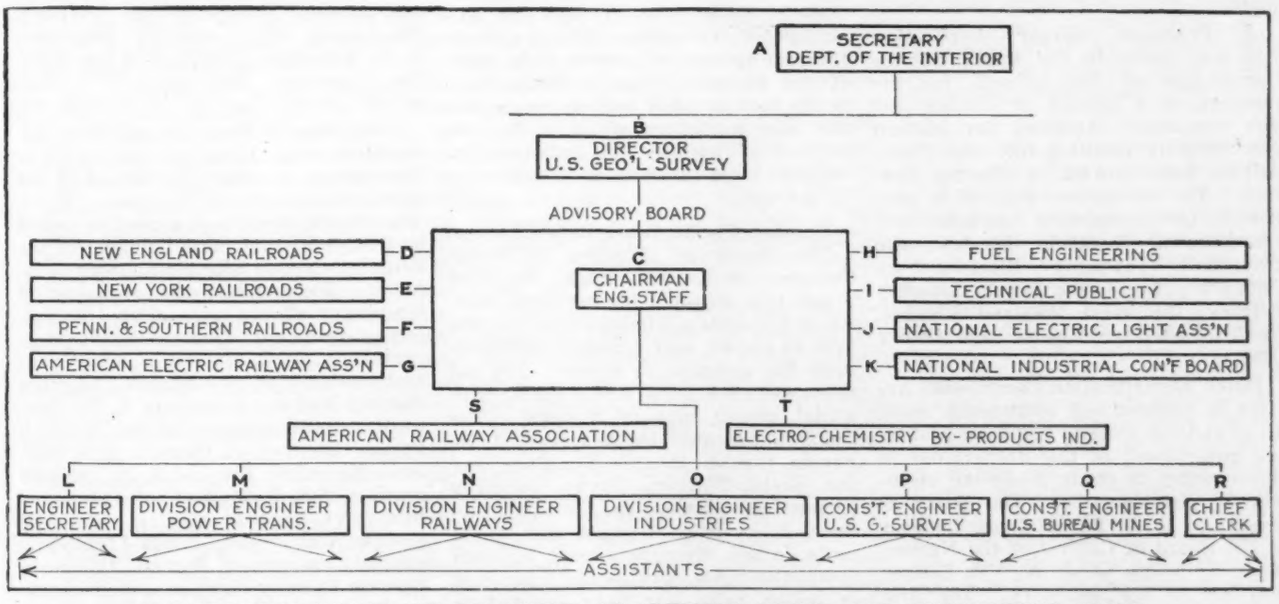
Plans are being formed for frequent conferences, comprehensive studies, surveys and tests during the coming year by which the National Electric Light Association can aid the Bureau of Standards to such a knowledge of the determining factors as will permit a thoroughly adequate treatment of the subjects covered by rules which impose a burden on the electric power industry and on users of electric service. This, it is expected, will result in the formulation of rules whose reasonableness can be demonstrated.

Organization of Super-Power Zone Engineering Staff

ORGANIZATION of the engineering staff which is to make an investigation and report under the auspices of the United States Geological Survey in the matter of the super-power survey between Boston and Washington has just been announced by W. S. Murray, chairman. The personnel and form of organization of the engineering staff are shown in the accompanyirg diagram. It will be seen that the organization is composed of an advisory board representing the various railroads, engineering, technical publicity, the National Electric Light Association, the American Electric Railway Association, the American Railway Association, the National Industrial Conference Board and other related interests. In addition, seven assistants make up the enginering staff, whose duty will be the collaboration of field data and its preparation for the report.

The services of the chief hydraulic engineer of the United States Geological Survey and of the chief mechanical engineer of the Bureau of Mines will also be contributed in part to the engineering staff of the super-power survey.

The work is to be divided into three departments—one of railway investigation, one of power and transmission investigation and one of industrial investigation. Meetings of the advisory board will be called not less than every two months, when the chairman of the engineering staff will review the progress of the work and the procedure during the next two months will be outlined. It is expected that all fundamental data, maps and diagrams will be collected by May 1, 1921. This will allow two months for the final preparation of the report text for presentation June 30, 1921, when the Congressional appropriation terminates.



ORGANIZATION CHART AND PERSONNEL OF ADVISORY BOARD AND ENGINEERING STAFF FOR SUPER-POWER SURVEY BETWEEN BOSTON AND WASHINGTON

A. John Barton Payne, Secretary Department Interior.
B. George Otis Smith, Director U. S. Geological Survey.
C. W. S. Murray, consulting engineer, New York, chairman engineering staff.
D. E. G. Buckland, vice-president, N. Y., N. H. & H. R.R.
E. A. T. Hardin, vice-president, N. Y. C. & H. R. R.R.
F. Appointment not made.
G. John H. Pardee, president A. E. R. A.
H. L. P. Breckenridge, head department mechanical engineering. Yale, chairman advisory board.
I. James H. McGraw, president McGraw-Hill Company.
J. Appointment not made.
K. Magnus W. Alexander, managing director National Industrial Conference Board.
L. Henry Flood, Jr., consulting engineer, Pittsburgh, Pa.
M. L. E. Imlay, consulting engineer, Niagara Falls, N. Y.
N. Cary T. Hutchinson, consulting engineer, New York.
O. Henry W. Butler, consulting engineer, New York.
P. N. C. Grover, chief hydraulic engineer, U. S. Geological Survey.
Q. O. P. Hood, chief mechanical engineer, U. S. Bureau of Mines.
R. J. J. Madigan, chief clerk, U. S. Geological Survey.
S. R. H. Aishton, president American Railway Association.
T. Appointment not made.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Direct Radio Service to Poland—The latest foreign nation to be brought into direct communication with the United States by means of radio service is Poland, the Radio Corporation of America having announced that service with that country has been established.

Y. M. C. A. Radio Course.—The department of education of the Young Men's Christian Association of New York City, East Side Branch, is organizing a course in the theory and operation of vacuum tubes. A booklet with full information can be obtained from A. R. Nilson, the secretary.

Sandusky's New Rates.—The schedule of electric rates recently approved by the City Commission of Sandusky, Ohio, for the Sandusky Gas & Electric Company eliminated the 4-cent step in residence lighting, all energy in excess of 60 kw.-hr. being now 5 cents instead of 4 cents. An increase of 10 per cent was granted for commercial and sign and window lighting, and the same increase with a coal-clause provision for motor service. The minimum charge was raised from 50 cents to 75 cents a month.

A Proposed Merger.—Application has been made to the Public Service Commission of Pennsylvania for the merging of a number of electric and gas companies chartered for eastern Pennsylvania counties into the Philadelphia Suburban Gas & Electric System. The companies that it is proposed to consolidate include the Charlestown Township Electric, the Schuylkill Township Electric, the Thornbury Light, the North Coventry Electric, the West Pikeland Electric, the Dilworthtown Electric and twelve others.

Dutch Electrification Commission Arrives in America.—A commission made up of railway experts has been sent by the government of the Netherlands to this country to study American methods of electrification. The party is headed by L. M. Barnet Lyon, member of the Board of Control of the Netherlands Railways. J. J. W. Van Loenen Martinet is the secretary. The first government line in Holland to be equipped will be that between Amsterdam and Rotterdam, a distance of about 55 miles. Other electrifications will follow. A super-power system is also proposed. The equipment will be largely multiple-unit, though locomotive operation will also be required. The commission will make a thorough study of American electrifications.

Public Utilities Law for Texas.—In an effort to obtain the enactment of a state public utilities law that will meet the indorsement of the various interests concerned, Governor W. P. Hobby has appointed a committee, representing the cities, the utilities, the legal fraternity, the Legislature and other bodies, to draft a bill which will be submitted at the next regular session of the Legislature in January, 1921. The League of Texas Municipalities, which is composed of the mayors and other officials of the different cities and towns of the state, is back of the movement.

Big Hydro-Electric Plant for British Columbia.—When the Bridge River power plant at Lillooet, B. C., on which work has begun, shall have been completed, the province will boast a hydro-electric development rated at 400,000 hp. The project involves an expenditure of $30,000,000. A fall of 1,000 ft. is to be taken advantage of, and a tunnel a mile and a half long is to be built through Mission Mountain to convey the water from Bridge River to Seaton Lake. Much of the power is to be distributed to Vancouver and Victoria, whose manufacturing prestige, it is expected, will thereby be greatly enhanced.

Building Operations in 1919.—Despite the discouraging reports concerning building operations, complete returns made to the United States Geological Survey from the building departments of 141 of the larger cities of the country show a large increase in 1919 compared with 1918. The building operations in these cities in 1919 cost $1,302,998,607, as against $430,014,365 in 1918, an increase of 202 per cent. Much of this advance is due to the increase in the cost of labor and materials, but this does not cover all of it, for the number of permits for buildings increased from 210,538 to 362,811, or 72 per cent.

Further Pacific Coast Rate Changes.—The Northwest Traction & Power Company of Everett, Wash., has filed a new rate schedule for residence service of 7.5 cents a kilowatt-hour for the first 45 kw.-hr. and 3 cents a kilowatt-hour for amounts in excess. The old rates were 8.8 cents and 6 cents, with a flat power rate of 3 cents. The California commission has granted the Pacific Gas & Electric Company and the Great Western Power Company permission to reduce their cooking rate from 4½ cents a kilowatt-hour to 3½ cents in all districts served by both companies. An increase of 15 per cent in power rates has been granted to the Coast Valleys Gas & Electric Company by the California commission, the lighting rates remaining unchanged. This increase is in the nature of a surcharge and will remain in effect for nine months, the length of time that the Pacific Gas & Electric Company, from which the Coast Valleys Company purchases its power, may enforce a similar increase.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

National Association of Electrical Inspectors.—The annual meeting of this association will take place in Philadelphia on Tuesday and Wednesday, Oct. 12 and 13. An executive meeting will be held in the auditorium of the Underwriters' Association of the Middle Department on Oct. 12.

Western Massachusetts Engineering Society.—C. C. Chesney, general manager of the Pittsfield works of the General Electric Company, was elected president of the Western Massachusetts Engineering Society recently. Other officers are: First vice-president, George E. Williams; second vice-president, E. E. Lockridge; secretary and treasurer, Winfield E. Holmes.

Chicago Section, American Welding Society.—The Chicago Section of the American Welding Society was organized in the rooms of the Western Society of Engineers on the evening of Aug. 3. Between eighty and eighty-five were present. Local by-laws were adopted and the following officers were elected: Chairman, M. B. Osburn, assistant superintendent Pullman Car Works, Pullman, Ill.; vice-chairman, O. T. Nelson, president General Boilers Company, Waukegan, Ill.; secretary-treasurer, L. B. Mackenzie, publisher of the *Welding Engineer*. Meetings will be held on the second Tuesday of each month.

Vancouver to Have Co-operative Association.—An Electrical Co-operative Association to unite all branches of the electrical industry in Vancouver, B. C., was started recently at a meeting called by George Kidd, general manager of the British Columbia Electric Railway Company. To complete the organization temporary officers were elected as follows: President, George Kidd; vice-presidents, W. G. Murrin, assistant general manager of the British Columbia Electric Railway Company; R. F. Hayward, general manager of the Western Power Company of Canada, and William McNeil. The advisory council consists of E. E. Walker, sales manager British Columbia Electric Railway Company, chairman; James Lightbody, publicity manager British Columbia Electric Railway Company; J. R. Read, local manager Canadian Westinghouse Company; H. Pim, local manager Canadian General Electric Company; J. F. Little, local manager Northern Electric Company, and W. C. Mainwaring, district sales manager Northern Electric Company. The jobbing houses were represented by F. P. Cope and E. B. Horseman and the contractor-dealers by E. Brettrell, S. E. Jarvis and W. W. Fraser.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Penalty in Lieu of Discount.—A penalty of 5 per cent on electric service bills not paid on or before the fifteenth day of the month following rendition of service has been approved by the Missouri Public Service Commission in lieu of a discount for prompt payment.

Restricted Street-Lighting Service at Former Rates Approved.—In granting increased rates to the St. James Ice, Electric Light & Power Company the Missouri Public Service Commission permitted the company to limit its electric service from sundown until midnight, the charges per lamp per month for street lighting to remain as before, basing its permission on the fact that the company was operating at a loss.

Fixing the Rate Base.—The California Railroad Commission will not include as a whole in the rate base upon which consumers of the owning company are required to provide a return the investment of an electric utility in a steam generating plant which is operated virtually for the sole purpose of generating energy for another utility. Nor will it consider as a part of the present rate base investments in a plant a large part of which is under construction at the time of valuation and on which interest is capitalized during the construction period.

Duty of Utility to City Served.—In ordering the Pacific Gas & Electric Company to extend its water service to outlying plants in Stockton the Railroad Commission of California laid down the general proposition that the company had "dedicated its service" to that city and held it to be "reasonable that it should provide service for the growth of the city." In view of a lack of available customers, however, the commission allowed a surcharge, to be added to monthly bills until the gross annual revenue from the extension shall reach at least 20 per cent of the capital invested in the extension.

Permitted Surcharge Not Applicable to Minimum Rate.—The Missouri Public Service Commission in authorizing the Union Electric Light & Power Company of St. Louis to add to its bills a surcharge of 5 mills per kilowatt-hour did not, it announced at the hearing of a customer's complaint, mean that this sum could be added to the accounts subject to the minimum charge, and the company was in error in so interpreting the order. The commission, therefore, while without authority to assess damages or inflict punishment for the wrongful charge, approved the restitution by the company of the excess amount charged in mistake.

New and Old Irrigation Customers.—In passing upon the application of the Idaho Power Company for greatly increased irrigation pumping rates (see ELECTRICAL WORLD, June 19, page 1444), the Idaho Public Utilities Commission declared that a higher rate for new irrigation customers than for old customers is justified when new investment is required to care for the new customers, when the peak of the load is in the summer during the irrigation season and when the old customers commenced extensive reclamation projects at a time when the peak load was in winter and consequently had comparatively low rates accorded to them.

Demand and "Hours' Use" Factors.—In its hearing upon the application of the Douglas County Light & Water Company for the authority necessary to increase rates for electric and water service the Oregon Public Service Commission criticised the company's existing form of electric rates for both lighting and power because it took into consideration only the quantity of energy consumed. The commission worked out a form for a schedule taking into consideration also the amount of the demand on the utility plant and the number of hours' use. The commission further registered its disapproval of flat rates and combined light and power rates as leading to discrimination.

Extension of Service Lines Beyond Corporate Limits.—Rendition of electric service to some consumers outside the corporate limits of the municipality served by a utility obligates the utility, according to a decision of the Missouri Public Service Commission, to render service to others similarly situated when the necessary extensions are justifiable. In pursuance of this principle the commission held that the expectant revenue justifies the extension of service by an electric utility 600 ft. or 700 ft. for the supply of six private consumers and two street lamps, upon condition that a consumer situated 200 ft. from other consumers and outside the corporate limits advance one-half of the direct cost incurred for his extension.

Elements Involved in Fixing Rates.—Asserting that it has the power to increase rates regardless of those fixed by a municipal franchise and that it can regulate the service of a public utility regardless of the provisions of its franchise when such franchise has been surrendered for an indeterminate period, the Arkansas Corporation Commission established for the Arkansas Light & Power Company in the city of Newport a schedule of electric rates drawn to yield a return of approximately 8 per cent. The value of the service, the commission said, was not the sole factor to be considered. Any just rate must necessarily be controlled largely by three distinct factors, namely, the value of the property, the cost of operation and the quality of the product sold, and to these three the number of consumers might with propriety be added.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Powers of Colorado Commission.—In the course of a recent decision in an action brought against the Public Utilities Commission of Colorado by a steam railroad the Colorado Supreme Court made a general statement affecting all utilities to the following effect: It was the intent of the Legislature to empower the Supreme Court to set aside or modify the orders of the commission if they were based on propositions of fact in support of which there is no evidence, but not to review findings of fact upon which the evidence is conflicting, that being a function of the Commission. (188 Pac. 747.)*

Confiscation Needs Convincing Proof.—In the case of a gas company against the Public Service Commission for the First District of New York, where it was sought to have the maximum-rate statute declared unconstitutional, the Supreme Court of the State has declared that before a rate will be deemed unconstitutional confiscation must be established by evidence which is convincing beyond a fair doubt. Where the product of the company is purchased from another corporation under the same management the most convincing proof of the fairness of the agreement must be produced before the rates fixed will be declared unconstitutional by the court. (181 N. Y. S. 623.)

Public Utility Procedure Not Changed by Creation of Kansas Court of Industrial Relations.—The Supreme Court of Kansas has thus construed the law as regards appeal against decisions of the Court of Industrial Relations established in that state: The law creating this body gives it authority over two classes of subjects—regulation of public utilities and regulation of industrial relations. On its public utilities side the court is simply the successor of the Public Utilities Commission and orders made in the field of public utilities regulation are to be reviewed as before. Section 12 of the act provides a method for the review of orders made in the field of industrial relations only, and it is the public policy of the state, established by the Legislature, that any controversy which falls within the jurisdiction of the Court of Industrial Relations on its public utilities side shall be adjusted there, subject to such review by the courts as the public utilities act prescribes. (190 Pac. 747.)

*Left-hand numbers refer to the volume, right-hand numbers to the page of the National Reporter System.

D. J. Bittel, sales superintendent of the Consumers' Power Company at Battle Creek, Mich., has resigned. George Longwell succeeds Mr. Bittel.

S. W. Webb, formerly local manager of the Consumers' Power Company at Albion, Mich., has been appointed district manager at Cadillac, Mich.

Major Lewis W. Call has been selected as chief counsel for the Federal Power Commission. Major Call has been transferred from the office of the Judge Advocate General of the army.

Col. Bion J. Arnold, well-known consulting engineer of Chicago, has been retained by the Hydro-Electric Power Commission of Ontario to make a report on the cost, earnings and operating expenses of the proposed hydro-electric radial street-railway systems.

Robert F. Whitehead on Aug. 9 was appointed Commissioner of Patents by President Wilson, to succeed James P. Newton, who has resigned. At the same time Melvin H. Coulston was appointed First Assistant Commissioner of Patents. Both Mr. Whitehead and

R. F. WHITEHEAD

Mr. Coulston have been members of the Patent Office staff for more than eighteen years. The former entered the service Feb. 1, 1902, the latter thirteen days later. Mr. Whitehead is a native of Virginia and maintains his legal residence at Lovingston in that state. He was educated at the University of Virginia. He is a lawyer and has worked up through the various grades of examiner. Mr. Coulston is from New York and a graduate of Cornell University. He is serving his second term as president of the Patent Office Society.

Charles O. Lenz, a well-known consulting engineer of New York City, with offices at 120 Broadway, has been appointed one of the consulting engineers for the Foundation Company of that city.

W. B. Head, vice-president of the Dallas Power & Light Company and assistant to the president of the Texas Power & Light Company, has been appointed a member of a committee named by the Governor of Texas to draft a public utilities commission law.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. D. Church, formerly manager in the San Luis district of the Midland Counties Light & Power Company, California, has been transferred to the Santa Maria district, relieving Mr. Ten Eyck, who has returned to college.

N. Sigimura, electrical engineer of Tokyo, Japan, and S. Kobori, mechanical engineer of the same city, are touring the United States and studying the latest electrical developments. They report that Japan is planning to develop large amounts of hydro-electric power to take care of the manufacturing which has increased so rapidly.

Dr. S. W. Stratton, director of the National Bureau of Standards, has sailed for Europe to attend the meetings of the International Bureau of Weights and Measures in September. He will be the principal American representative to discuss proposed changes in function and scope of the bureau, to include custody of other standards than weights and measures and the promulgation of constants of materials or physical values.

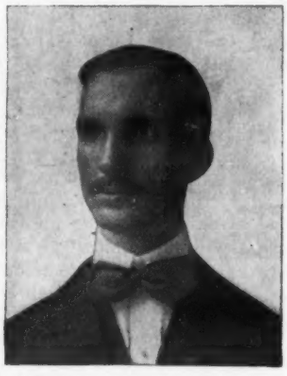
Paul Moore, who has been appointed secretary of the division of research extension of the National Research Council, will leave his present work as director of the information bureau of the War Trade Board to take up his new duties about Oct. 1. In the promotion of research, especially that of special interest to the industries, Mr. Moore will be associated with H. E. Howe, who is chairman of the division of the Research Council.

W. E. Blodgett, formerly secretary and treasurer and in charge of accounting of the Utah Light & Traction Company, has just been appointed comptroller of the Winnipeg Electric Railway Company, Winnipeg, Manitoba, Canada. Mr. Blodgett, who is a native of Wisconsin, gained his first accounting experience there and in Minnesota. He was accountant for the Twin City Rapid Transit Company, serving Minneapolis and St. Paul, prior to 1907, at which time he became associated with the Utah Light & Railway Company. He successively filled the positions of paymaster, statistician, chief clerk, assistant secretary and chief clerk to the general manager. After the consolidation in 1914 of the Salt Lake Light & Traction Company and the Utah Light & Railway Company to form the present organization, Mr. Blodgett became chief clerk to the general manager and to the secretary and treasurer. In 1916 he was elected secretary and treasurer of the company.

G. J. Walton has resigned as local manager of the California-Oregon Power Company at Klamath Falls, Ore., to engage in private business. Mr. Walton has been connected with the company named since 1906.

Lieut. Col. B. O. Clupek of the Czechoslovak army is traveling through the United States in the interests of the new state of Czechoslovakia. His principal interest is in hydro-electric development, and he is now visiting California and the Northwest.

E. H. Martindale, who took office on Aug. 1 as vice-president of the American Institute of Electrical Engineers, is president of the Martindale Electric Company of Cleveland. Mr. Martindale was graduated from the Case School of Applied Science in 1908. After experience with the Illinois Steel Company and the Commonwealth Edison Company he joined the staff of the National Carbon Company of Cleveland in 1910 and was placed in charge of the company's brush-testing laboratory. In 1912 he was made sales



E. H. MARTINDALE

engineer for the company on carbon brushes. Mr. Martindale has conducted original studies on the use of carbon brushes and presented his results in various publications and in a paper before the A. I. E. E. During the war he served as captain of engineers in service overseas. Last year he served as a member of the board of directors of the Institute.

Obituary

Howard L. Olds, vice-president Twin State Gas & Electric Company, Boston, Mass., died recently at York Village, Me. Mr. Olds was born at West Chesterfield, N. H., about fifty-one years ago. For some time he was identified with public utilities in Indiana, Illinois, Ohio and Detroit, Mich., and in 1916 took charge of the Eastern properties of the Middle West Utilities Corporation. He was a member of the executive committee of the New England Section, N. E. L. A.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Insulating Paper Is Scarce, but Outlook Hopeful

MAKERS of electrical products which require insulating paper in their manufacture are confronted with a marked scarcity of this paper, chiefly on account of the difficulty in securing raw material, though it seems that the situation will soon improve. The demand for insulating paper is especially heavy at present because of the large orders being placed for power and telephone cables and condensers. Power-cable manufacturers report that their orders have about doubled, but they are paying prices varying from 23 to 30 cents a pound for paper which cost them 19 to 22 cents last January.

Old manila rope and rags, the two bases from which the best paper is made, are very hard to obtain. The principal source of supply of scrap rope is the shipping industry, and as there has been a falling off in transportation by water due to strikes and other causes, a shortage has resulted. Another factor which is active in diminishing the junking of rope is the high price of new rope, which is due to the great cost of raw hemp and the excessive demand from new ships being built. Rags are also scarce because the importation from foreign countries, which was formerly the chief source of supply, has been cut off. Quite lately, however, shipments from abroad have been resumed to some extent. As a substitute for these raw materials, wood pulp has been experimented with but has not yet been accepted by insulation manufacturers as a basis for the best papers. Moreover, wood pulp itself is difficult to obtain.

The very thin "glassine" all-linen paper, imported before the war chiefly for use in condensers, has been practically cut off from importation. American manufacturers have recently developed a paper said to be as good as the imported material, however, although it contains a large proportion of cotton. Another reason for the scarcity of insulting paper has been that the best grade of whiting, which is used in its manufacture, formerly came from England and the supply from that source has been cut off until a month or so ago.

Manufacturers express a hopeful view of the situation, however, because they seem to expect that the foregoing causes of shortage will soon disappear. Furthermore, European countries, including Norway, Sweden, Finland and Italy, are beginning to produce paper again for the first time in several years.

Low Cotton Has Not Affected Prices of Electrical Goods

DESPITE recent drops in the prices of cotton electrical products containing this material have not yet generally declined in price. About the only drop of importance has been a considerable reduction about Aug. 15 in the price of some lines of cotton insulating tape and webbing. In general the reasons for the firmness are the excellent demand, the large number of unfilled back orders, the high labor cost and the fact that the price of cotton is a small part of the cost of finished products. Another reason is that the spinning mills still have some 40-cent cotton with which they are filling orders placed some time ago.

In the matter of cotton insulating tape, which is more directly dependent on the price of cotton than other electrical products, there was in some cases a notable drop in price about the middle of August. The demand for this material is just ahead of the supply, though deliveries are not longer than one month. The thinner grades are harder to get as the fine yarns are scarce. Cotton-sleeving deliveries are made in two to six months. There is a very heavy demand for this material, which cannot be met by the mills because of a scarcity of sleeving machinery. Friction tape is more plentiful than it has been for some time and immediate deliveries can usually be made. No changes in price are reported.

Prices of lamp cord have not changed. Until recently manufacturers have been busy catching up with back orders, but at present deliveries are good in the face of a fair demand. The fine yarns used on magnet wire are difficult to obtain; consequently there is some scarcity of this material and prices are firm.

Stocks of non-metallic flexible conduit are in good shape and the demand is fair. Prices are holding firm.

Cloth manufacturers are hoping for still lower cotton, crop prospects are good and there is talk of heavy cancellations by tire manufacturers who use an enormous amount of cotton fabrics, but in spite of these factors manufacturers of electrical material whose basis is cotton state that present prices will hold firm for several months.

Lighting Glassware Raw Materials Show Little Shortage

ALTHOUGH reports circulated from the Middle West tend to show that there is a bad shortage of raw materials necessary to the marketing of lighting fixture glassware, representatives of some of the largest glassware manufacturers have stated to the ELECTRICAL WORLD that they are finding no particular shortage in these materials. They are prepared to commence shipment of large orders of commercial glassware of a rather plain design in from three to six weeks and in some cases make complete shipment in that time. Where there is considerable labor required to the finish of the glassware, these shipments may run up to six months. From this it appears that a lack of skilled labor rather than of raw materials is the deterrent factor.

The demand for commercial glassware has been heavy, and manufacturers say they see no let-up in the near future. The demand for residence glassware, on the other hand, has fallen off a bit; but it is expected that it will be resumed in good volume with better transportation facilities for the movement of building materials and a consequent easier price with the increased supply.

As for the raw-material question, it is true that the supply of European materials which some glassware makers depended upon has fallen off. But at the same time it appears that the domestic materials, which took the place of the foreign during the war, are being produced in better quantities and of an increasingly better quality, and many manufacturers are using them in whole or in greater part. It is doubtful that they will go back to foreign materials

again. There has been quite a heavy breakage, however, in glass pots made from domestic clay. This entails considerable loss not only of the pots but also of the liquid glass which is spilled.

Several factors are responsible for higher prices of the glassware. Labor turnover, particularly among the unskilled, has resulted in larger volume of rejections and breakage, breakage of pots and loss of liquid glass has added their toll, cost of overhead on lowered production is higher per unit, and the demand of labor for higher wages has just made itself felt. At the conference in Atlantic City in July the workers asked for increases ranging from 25 to 50 per cent all around. It was finally settled at different stages running from 5 to 14 per cent for those connected with electrical glassware. The average raise was about 10 per cent. Some of this is effective at once, while some will become effective Sept. 10. It is probable, however, that increases in the price of finished glassware will amount to more than the 10 per cent advance to labor.

Mills are not running up to capacity because of labor shortage, the average amount of production being about 80 per cent of installed capacity. This, with the heavy demand, is causing manufacturers to shorten the period of their regular summer inventory and repair shutdowns. It does not seem that there is any need for ordering lighting glassware too far into the future with shipments quoted around four to six weks on ordinary commercial glass, but with up to six months quoted on very fancy glass a certain amount of advance ordering must of course be considered. All things considered, the market seems to be in pretty good conditi.on.

Promising Market for Electrical Devices Abroad

COINCIDENT with the news that manufacturers of electric household appliances must soon develop new devices in order to stimulate domestic demand which in some quarters is said to have reached its peak for those machines now on the market in this country, comes more and more evidence of the increasing demand abroad in this line. The figures of the Bureau of Foreign and Domestic Commerce show that the value of exports of heating and cooking appliances for the first six months of 1920 amounts to $921,575, as compared with $814,002 for the same period in 1919, or an increase of 13 per cent. The total exports for this class of material for the entire year 1919 amounted to $1,579,757, or more than double the figures of $686,339 recorded in 1918.

Switzerland seems to rank as one of the most fertile of foreign markets for appliances, for with the increasing supply of electrical energy furnished by the development of that country's vast water-power the use of electrically driven devices there is steadily increasing. In the past the use of such machines in Switzerland has been limited, washing machines, for instance, having been used only in public laundries. The country does not engage heavily in the manufacture of this class of goods, most of the material having been imported from Germany in the past. Appliances introduced in the country have to reckon with both direct current and one-to-three-phase alternating current of 100 volts to 500 volts and higher. In some sections of Switzerland the sale and installation of electric motors is a monopoly, but managers of power plants are anxious to assist in introducing electric appliances for household use in order to increase the consumption of energy, and they seem to think that now is the proper time for such appliances to be introduced.

The hydro-electric wealth of Italy is also being developed at a rapid rate following her reconstruction from war conditions, and manufacturers of electrical goods should find a very promising field there for their products. The energy for industrial and commercial use, while absorbed as quickly as it is produced, is extremely cheap and should be abundant within a few years.

In England a large selling organization has been in the market for labor-saving devices as a means of meeting the servant problem in that country. While the houses in England are not generously supplied with electricity, it is felt that the greater use of electricity there is assured and that a large field will then be opened up for electrical devices. The annual report of the Leeds (England) Corporation Electricity Department seems to bear this out in showing an increase in the use of electricity for domestic and heating purposes from $30,000 to $60,000 in 1919. The number of consumers also increased from 1,686 to 2,140. Many applications had to be refused owing to the fully loaded lines in certain districts.

One of the big difficulties in the path of the widespread use of American makes of appliances abroad has been differences in voltage and differences in the connections used, especially the latter. Steps toward remedying the objections against varying types of attachments have already been undertaken in this country, however, in a movement to standardize plugs and receptacles.

Foreign trade experts warn manufacturers not to cultivate customers abroad unless they take pains to accord to them the same, if not greater, courteous consideration that is extended to customers at home.

Metal Market Situation

THE copper market continues dull and lifeless, few sales being made either for nearby or future delivery. Consumers' demands for the third quarter have mostly been covered, and requirements beyond that period are not being anticipated because buyers are awaiting price developments. Producers are holding firmly at 19 cents and refuse to shade that price under inducement of attractive orders. In spite of the present weak demand, their position appears strong because consumers have allowed stocks of copper to become reduced to the danger point while hoping for lower prices to develop, and a heavier buying movement seems likely to materialize. The need of foreign countries for copper is great too, and it is only an unfavorable exchange rate which prevents large orders from that quarter. The general feeling is that the higher freight rates will be the occasion for an advance in price.

The outside market is also exceedingly quiet, and although prices are nominally shaded from ½ cent to ¼ cent, sellers do not seem very anxious to take orders at that price. Small interest is being taken in standard copper at London, but the market holds steady, spot advancing £1 during the past week.

Straits tin has taken a drop of 2¼ cents in the last fortnight, and the market presents a weak and inactive tone. Demand for lead is light, and considerable apprehension is expressed over foreign competition, as lead from abroad can at present be delivered duty-paid in this country at a price of about ¼ cent per pound less than the market price here. A slight advance in spot zinc reflects the firm market that exists because of fears of a coming scarcity owing to strikes and the closing down of smelters. Only small quantities are being offered for sale and demand is rather active for prompt shipment.

NEW YORK METAL MARKET PRICES

	August 17	August 24
Copper		
London, standard spot	£ 93 5 0	£ 94 5 0
	Cents per Pound	Cents per Pound
Prime Lake	18.75 to 18.85	18.75
Electrolytic	19.00	19.00
Casting	18.00	18.00
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	9.00	9.00
Antimony	7.00	7.00
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	8.35	8.50
Tin	48.00	45.75
Aluminum, 98 to 99 per cent	35.10	35.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.50 to 16.00	15.50 to 16.00
Brass, heavy	9.25 to 9.50	9.25 to 9.50
Brass, light	7.25 to 7.75	7.25 to 7.75
Lead, heavy	7.25 to 7.50	7.50 to 7.75
Zinc, old scrap	5.25 to 5.50	5.25 to 5.50

THE WEEK
IN TRADE

CONSIDERABLE pessimism is evident in Southern territory over a prolonged rainy spell which has injured crops and reduced sales. In the Northwest complaint is also heard on the part of the important lumber industry there, which faces ruin if its appeals for modification of the freight rate advances are not granted. In the Intermountain section the general tone is, by contrast, very optimistic. Increased sales are coming from the many strikers who have returned to work, crop prospects are bright, and the lowest point of business inactivity seems to have passed.

Shipments are improving except on the Pacific Coast, where the car requirements for lumber, grain and fruit are precluding the accumulation of satisfactory stocks. In Eastern and Southern territory, however, the transportation situation is decidedly better, and fair stocks are building up in many lines. The chief items whose scarcity is felt throughout the country are porcelain, rigid conduit and hollow ware.

The usual fall increase in demand for seasonal goods has not yet made itself felt, and sales continue to be reported light in all districts. The Far West characterizes collections as fairly prompt, but this is the only exception to a consensus of opinion from all sections, which is finding money tighter and collections becoming slower and more difficult to accomplish.

NEW YORK

Little change is evident in the week-to-week trade. Business is in rather a quiescent state, seeming to await the expected heavier buying movement of the fall season which is looked for in certain lines, but these anticipations have not begun to materialize. Jobbers generally report a slow volume of trade but do not consider sales alarming by any means. In fact, in the light of the usual summer demand, this season's business is reported as normal at least.

Jobbers vary in their view of the credit situation, but on the whole it appears to be less favorable and collections are slowing up materially. This is felt to be the natural result of lighter sales, tighter money and retrenchments.

Transportation is continuing to improve, and with better shipments the rule, good stocks are accumulating in many lines, especially in flexible armored conductor, insulating tape, schedule material and switches. Stocks of porcelain and heating appliances still leave much to be desired, however. The rigid conduit situation varies, but on the whole is better in this territory. A shortage of heating appliances is expected to materialize before the holiday trade is over. Practically no building activity along residence lines is under way, but in some quarters the lower price of building material is expected to stimulate this activity. Prices continue firm.

Schedule Material.—Stocks are reported plentiful and shipments are occasioning no trouble. Demand is fairly good.

Knife Switches.—Regular receipts have caused good stocks to accumulate. Demand at present is fairly heavy.

Conduit Fittings.—Demand is good, but some jobbers say it has fallen off a bit. Stocks in many cases are in good shape, but in some instances supplies are short on many items. Shipments are slow.

Rigid Conduit.—Varying conditions feature this market. Local supplies have eased up to some extent, and occasionally large stocks are found. But many jobbers still have no stock or are short on certain sizes. Shipments are irregular and a good demand is found, though it is slightly less heavy as better receipts become available.

Tape.—Good stocks of both rubber and friction tape are reported. Demand is only fair and is not as heavy as it was. Shipments are fairly regular. Friction tape ranges from about 55 to 60 cents per pound, and rubber is quoted the same price by some jobbers and slightly less by others.

Flexible Armored Conductor.—Demand is decidedly off and prices are being cut to some extent. Receipts are coming in regularly and good stocks have accumulated with most jobbers.

Porcelain.—Demand has slightly fallen off, but shipments are very irregular and the scarcity continues. Very small and incomplete stocks are on hand, tubes being especially scarce.

Flashlights.—Demand has been fairly good, but sales campaigns have apparently not brought the results that were expected. No trouble in securing supplies has been experienced, and jobbers are well stocked up.

Heating Appliances.—Present shipments are slow and receipts only arrive on orders which are months old, so that the scarcity has almost stifled demand. Stocks are very low with flatirons in the best shape. A big shortage for the holiday trade is expected.

Vacuum Cleaners.—The market has fallen off until very few cleaners are sold at present, but a more active demand is looked for soon. Jobbers are well stocked up and have had no difficulty in obtaining supplies.

CHICAGO

Improvement in transportation facilities is building up jobbers' stocks, though they are still very spotty. Collections are slower than they have been, and a number of cancellations have been received from contractors and industrial customers during the week. Many buyers are asking their jobbers for more time in which to meet their obligations.

There is a very general shortage of meters and transformers, and utilities that failed to place orders for their requirements during the first few months of this year are now unable to get anything like the number of meters and transformers they need. Central stations are also experiencing great difficulty in getting power-house maintenance supplies, such as firebrick, steel rope for cranes, repair parts, etc.

Prospective buyers of household devices are holding off for lower prices, and electrical retail stores are experiencing a regular pre-war summer slump in business.

Washing Machines.—The Federal Electric Company is placing a swinging-wringer type of washing machine on the market which will sell for $10 more than the stationary-wringer type. The list price of the new machine is $165 in galvanized iron and $190 in copper.

Porcelain.—Difficulty in obtaining porcelain is affecting the supply and delivery of practically everything which requires this material in any form.

Farm-Lighting Plants.—Most dealers are buying all the machines they can get, for although business is slow at the present time it is expected to be very good in the fall.

Poles.—Fairly good stocks are now on hand, and orders are coming in rapidly from buyers who wish to get in their supply before the increased freight rates go into effect.

Meters.—There are practically no stocks of house-type meters in dealer's hands, and most of the central stations either have all they need to carry them through the year or none at all. One utility company is trying to get 10,000 meters before the end of this year.

Transformers.—The conditions in the transformer market are very similar to those which apply to meters. The central stations which ordered a year in advance have all they need, but those companies that have been buying from hand to mouth have practically no stocks and cannot obtain any.

Non-Metallic Flexible Conduit.—Shipments have been received in fairly large quantities, and ½-in. conduit sells for $32 per 1,000 ft. in lots of 10,000 ft. or more. There is a fair demand but the majority of sales are on back orders.

Wire.—There is a good stock of most sizes of copper wire in Chicago, but it is divided among many jobbers. The greatest demand is for weatherproof. No. 6 weatherproof is quoted at 32 cents per pound in 1,000-lb. lots.

Line Hardware.—There is a brisk demand because buyers have learned that a price increase of about 10 per cent is expected soon. Stocks are spotty.

Household Devices.—Retailers generally have fairly complete stocks and their needs are well filled. More aggressive selling methods are necessary to keep stocks moving, however.

BOSTON

Quieter buying is evident in most of the leading lines of electrical material. New England manufacturers are generally utilizing this period to fill back orders and to accumulate stocks despite continued railroad embargoes and delays. Porcelain, small motors and rigid conduit, however, are scarce. Prices show little tendency to break, and deliveries are not much shortened over the quotations of early summer. Considerable hesitation in buying is apparent, and many concerns are ordering only upon a hand-to-mouth basis.

Industrial activity is well maintained, although some of the larger textile mills which were shut down a few weeks ago have not yet resumed. Unsatisfactory collections are reported, especially among the larger buyers. Some jobbers are selling on a forty-five-day payment basis to many small customers, while some of the best accounts are asking 90 to 120 days. Hesitation and uncertainty seem to be the cause of these spasmodic conditions. Central-station rate increases are being announced here and there, and the public is apparently accepting them in good faith. The coal situation is much improved among the larger utilities. Building and engineering contracts for the week ended Aug. 19 in New England total $5,490,000, compared with $6,513,000 for the same week last year.

Motors.—Deliveries of forty to forty-two weeks are being quoted on alternating-current motors of 1 hp. to 10 hp. rating and sixteen weeks on direct-current units. Occasional "pick-ups" are being made for prompt delivery, but there is no counting on the supply when definite sizes, types and speeds are desired. Prices are firm after the recent advances.

Lamps.—Fall buying has set in and some anxiety is expressed as to the ability of existing stocks to meet the demand. Manufacturers are pushing production, but occasional shortages are reported, notably in 100-watt gas-filled units. Steady prices rule.

Wire.—Immediate needs are being well met, but ten weeks' delivery is being quoted by a representative jobber on weatherproof in quantity, the base price being 29 cents. Some sizes of bare copper wire are being quoted on six to eight weeks' delivery, with price at 24 cents base. Rubber-covered wire is plentiful, No. 14 selling at $11 per 1,000 ft. in 5,000-ft. lots.

Fuses.—Rumors of a shortage appear somewhat exaggerated. Enclosed fuses up to 600 volts are selling at 35 per cent off list in standard packages. Plug fuses are a little handicapped by the shortage of porcelain, but the market is far from bare. The 15-amp. size sells at 5 cents each, in lots of 500 and over.

Non-Metallic Flexible Conduit.—Steady conditions are reported, with no price changes and good supply available for current requirements. Demand is slow. The ¾-in. size sells for $36.50 and the ½-in. size for $33.50 per 1,000 ft. in 1,000-ft. lots.

Magnet Wire.—This is extremely scarce, and quotations have been withdrawn by some manufacturing and jobbing interests. Smaller sizes of copper wire are scarce, owing principally to recent strikes in the mills.

Flexible Armored Conductor.—Demand is easier for the time being, and prices are steady. Single-strip, No. 14, sells for $110 per 1,000 ft. in 5,000-ft. lots.

Rigid Conduit.—Stocks are very spotty, some distributers reporting little pipe on hand, while others have fair supplies resulting from the arrival of long-delayed shipments. There is certainly no surplus stock in the Boston market. Prices are quoted from Card 45, but are subject to delivery conditions.

Heating Appliances.—Good stocks of flatirons are on hand, and the scarcity of toasters has been pretty well remedied. Representative irons are selling to dealers at 25 per cent discount in lots of one to five, and at 30 per cent off in lots of six. The same discounts apply to toasters. Hollow ware is scarce, manufacturing facilities having been concentrated largely upon irons and toasters.

ATLANTA

Rainy weather has served to check building activities and has done considerable damage throughout the section. Some pessimism regarding the cotton crop is generally expressed, as the heavy rains and cool weather have caused it to loose its excellent condition of two weeks ago. These poor weather conditions are reflected in a general slackening up in the receipt of orders, this being particularly true in the rural districts. Food crops are reported in good shape, and a resumption of sunshine will probably dissipate the pessimistic outlook.

While the car shortage continues about as reported last week, jobbers are slowly accumulating limited stocks of some materials, though not in sufficient quantities to be satisfactory. The fall trade has not yet begun to be in evidence, few orders for season specialties being reported.

Residential and small commercial construction continues, although permits in Atlanta for the first half of August presented quite a heavy drop as compared with the two previous months.

Money continues tight, and collections show no change. Bank clearings are slightly under the same period last year, but are well sustained.

Wire.—Fairly satisfactory stocks of rubber-covered are on hand in assorted sizes, but weatherproof continues scarce. A brisk demand, with quotations of 29 cents for rubber-covered and 31 cents for weatherproof, is reported.

Rigid Conduit.—The black-pipe situation continues to improve, but there are no stocks of galvanized pipe in the territory. Jobbers do not express any opinion when this condition will show improvement. Prices, lots less than 2,500 lb., black, ¾-in., $12.49; 1-in., $18.46; 2-in., $40.18.

Lock Nuts and Bushings.—The shortage of these fittings continues acute, with no easing up in demand. Local stocks are exhausted and shipments very poor. No price changes, however, are reported.

Porcelain.—Shipments of porcelain recently received were quickly absorbed, and a scarcity of this material is again reported. There are no ⅞-in. x 3-in. or 4-in. tubes in the territory, while knobs, cleats and other classes of porcelain are available in only limited quantities.

Heaters.—These are not yet moving, and there is quite a conflict of opinion as to the outlook for fall trade. Indications are, however, that heaters will not be so popular this fall as last, and no heavy orders are being placed.

Christmas-Tree Outfits.—Jobbers report that retailers are placing orders satisfactorily, and they predict a record business. Stocks are in good shape, with retail prices practically the same as last year.

Steel Reflectors.—Industrial-plant demands keep this line very active, the fall buying having still further stimulated the movement. Stocks are good, but shipments from factory on new orders are somewhat slow.

Interphones.—Most of the apartments now under construction are small and are not installing this equipment. Therefore sales are rather slow. Stocks are in fair shape.

Lead Cable.—Brisk demands for both lead and varnished cambric cable are reported, industrial plants placing heavy orders. Shipments are ranging from three to six months.

SAN FRANCISCO

There is an appreciable lull in all business, although electrical prices are steady and there is little indication of any drop there. Building operations are slower, and contractors are working two or three men where they usually employ a dozen. The appliance business, too, is stagnant, and buying generally is at a low ebb, the tendency being to run along on present stocks as far as possible. Pacific Coast stocks on this account are accumulating. Shipments from the East are slower because of heavy fruit movements and the large volume of shipping that has been induced by the impending freight rate advance. Collections are fairly prompt, averaging about fifty days.

Schedule Material.—Factory extensions are producing better shipments, yet back orders usually cause these to melt on their arrival. Because of shortages in Coast stocks of safety switches, whose use is required by state laws, a large amount of knife switches especially in the 60-amp. size are being sold.

Insulating Material.—Demand has picked up and tapes, mica material and fiber are showing a good movement. There seems to be a lull in the sale to motor-repairing firms, but wireless companies and export concerns are heavy buyers. Prices are steady and Coast stocks are good.

Washing Machines.—Good export sales and the establishment of Far-Eastern agencies are reported the past week. The appliance business is in an uncertain state because experienced salesmen are badly needed.

Ranges.—Deliveries from the factory are very poor and require the greater part of a year. Inasmuch as orders continue in a regular although small volume, it is necessary to do considerable substituting in order to cope with the shortage of salable sizes. Business will be solicited this winter from summer resorts so that installations may be made next season.

Heating Appliances.—Stocks are better. Further price advances are looked for, but there is no doubt that all the stock that can be secured will be sold during the Christmas season.

SEATTLE—PORTLAND

Trade along electrical lines in Seattle and the Puget Sound district shows no particular change over the past few weeks. Jobbers' sales are light, and retailers' business is fair but tending downward. Stocks, generally speaking, are in excellent shape with the exception of ranges, hollow-ware devices, electrical heaters and conduit.

Building remains quiet and indications are that previous predictions that fall would witness a resumption of residence construction in this section were too optimistic as construction of any consequence will be postponed until next spring. Lumbermen of the Pacific Northwest see ruin facing them if the freight rate advances are not later modified to restore competitive conditions now existing between the different producing centers. The lumbermen will probably appeal to the Interstate Commerce Commission and, if necessary, carry their case to the federal courts.

Portland manufacturers report that the week's business was about normal for this time of year. Incoming shipments are poor and back orders keep stocks depleted. Money is tightening up and collections are naturally slow. The price of all alternating-current motors advanced 15 per cent the past week. Jobbers report that business is firm but not improving materially. Financially, this season is about 15 per cent ahead of 1919, but in quantity of sales it is probably about the same as last year. Stocks on the whole are not improving, for as fast as new goods arrive they are shipped out again in order to care for back orders. Collections are getting slower and credit continues to tighten. Small dealers who started in business immediately following the armistice or during the war are beginning to show serious signs of being unable to weather the storm. Wherever such indications are shown credit is promptly withdrawn. The enormous unloading of government electrical material in this section has undoubtedly worked to the detriment of the trade. Depleted stocks and delayed deliveries from the heat are also factors in bringing about this condition, but on the whole the general business outlook seems to be improved over a few weeks ago.

Heating Appliances.—Demand is showing a noticeable increase with the approach of fall and practically every jobber is reporting short stocks. Shipments are irregular and delayed. Electric irons sell the best, closely followed by toasters, stoves and heaters.

Farm-Lighting Plants.—During the month of September various makes will be shown at several state and county fairs. Stocks are in excellent shape and deliveries are coming through satisfactorily. This year is expected to establish new sales records.

Household Appliances.—Shipments of washing machines, vacuum cleaners and sewing machines are coming through in good shape, and demand is strong although not so heavy as earlier this summer.

Lamps.—Stocks are beginning to move, especially residence types, but there are plentiful supplies to care for the demand.

Rigid Conduit.—Stocks are short in sizes ranging from ½ in. to 3 in. The scarcity has been acute, but the situation is somewhat easier because demand is lighter.

SALT LAKE CITY—DENVER

Indications point to better days ahead in the electrical trade. A slight improvement is noted in collections. Crops are beginning to move and dealers are able to collect more satisfactorily on outstanding accounts and to make remittances in turn to their jobbers. Dealers whose sales have been hampered somewhat by non-employment among those from whom they draw their trade are more hopeful now since the settlement of labor troubles. Hundreds of union men who have gone back to work are beginning to make their influence felt as a buying factor.

Jobbers and distributers are urging dealers to tighten up on collections and to be less prodigal in the extension of credits. Complaint has been made that many electrical dealers who have been concerned about their lack of sales are taking long chances in the matter of extending credit to doubtful customers. This tendency is very demoralizing to business. Jobbers and dealers have not relaxed their sales efforts through the dull summer period. The more sluggish business has been the harder they have worked.

A spirit of optimism prevails in the Intermountain region despite present adverse conditions. Far-sighted jobbers see big business ahead and are making their preparations accordingly. A feeling that the peak of inactivity has been safely passed is persistingly spreading in the West. The electrical trade is banking on the harvesting of crops, which is now well under way, and the prospect of a good yield is unusually bright. Shipments are good and dealers are now able to accumulate stock in mose lines.

Christmas Tree Outfits.—Jobbers are making their initial appeal to dealers to stock these goods along with appliances for the holiday trade.

Motors.—Dealers report difficulty in getting an adequate supply to meet present demands. Motors are now used extensively for pumping water for orchards and farms. Thus irrigation has created a special seasonal demand.

Washing Machines.—Some makes are still somewhat scarce. In other cases factories have caught up with orders and are urging jobbers to permit them to unload. Wringers as a separate unit are not plentiful. More of them could be sold if they were available.

Electric Irons.—This device is just having its initial introduction through extensive advertising campaigns. It is meeting with general favor and the prospects for business look good. The supply is not adequate.

Lamps.—There is a scarcity just at a time when the call for this merchandise is picking up.

Schedule Material.—Supplies are reported very short. Factories have not yet caught up with back orders. As a consequence construction work is seriously hampered.

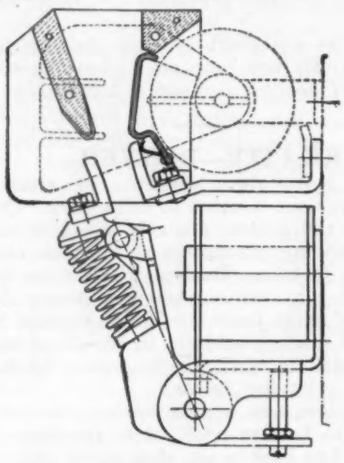
Rubber-Covered Wire.—There is a decided shortage here, though bare wire is reported plentiful.

New Apparatus & Appliances

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Arc Splitter

An arc splitter to lengthen the life of contactor tips has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It consists of a refractory

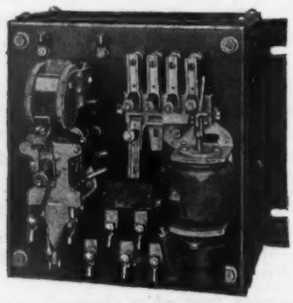


MAGNETIC BLOW-OUT CONTACTOR WITH ARC SPLITTER

element which is so placed in the arc box of the magnetic blow-out as to project into the path of the arc, thereby forcing the arc to pass around it and thus increasing its resistance, causing it to rupture more rapidly. The arc splitter is immediately above the contactor tips.

Elevator Controllers of Simplified Design

The entire line of elevator controllers manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee has been replaced by a new

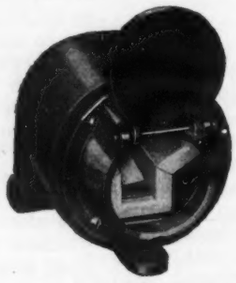


ONE OF NEW LINE OF ELEVATOR CONTROLLERS

line of fewer types and simpler construction. Among the new features are standardized carbon-to-copper power contacts, said to be non-freezing and quiet, and time-limit acceleration by a simple dashpot relay to provide smooth acceleration regardless of load. The time interval allowed the motor to come up to speed is determined by the setting of a dashpot relay which is externally adjustable. The relay serves to rotate a rocker arm carrying a series of fingers, which cut out resistance step by step or cause the accelerating magnet switches to close one by one.

Three-Phase Receptacle Has Spring Door

A receptacle for three-phase circuits having an extension with a spring-door cover has been developed by the Central Electric Company, 320 South Wells Street, Chicago. The extension is so constructed that it can be mounted on the receptacle in four positions so that the door can be opened to either side, to top or bottom, as desired. The dimensions when the receptacle is closed are: 7 in. high, 4¾ in. wide, 4¾ in. deep. This "Ralco" No. 610 EC receptacle is identical in construction to the old



SPRING DOOR MAY BE SET TO OPEN IN ANY DIRECTION

No. 10, except that it has the extension. The plugs are standard No. 10 "Ralco" plugs and are bored to take three-conductor No. 8 reinforced portable cord or smaller.

Notes on Recent Appliances

Vacuum-Tube Socket for Wireless Sets

The Precision Equipment Company, 2437 Gilbert Avenue, Cincinnati, Ohio, has designed a vacuum-tube socket equipped with grid "leak" for use in wireless sets.

Electric Clothes Washer

The Odin Company, 325 West Ohio Street, Chicago, has brought out a revolving cylinder clothes washer.

Self-Cleaning Lighting Fixture

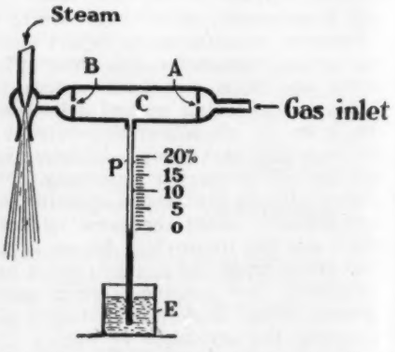
An industrial lighting fixture which cleans itself every time the light is swiched on or off has been placed on the market by the Associated Engineers Company of 180 North Dearborn Street, Chicago, under the name of the "Clean-Pull" unit. The fixture consists of a reflector, a pull switch, a cord and a cleaning device consisting of two wiping blades. Every time the cord is pulled to operate the switch it simultaneously brings the two wiping blades into action. Each blade makes a complete revolution, one against the reflecting surface of the reflector and the other against the lamp bulb. In this way the dirt is swept off both lamp and reflector. The fixture is made to take 300-watt to 500-watt

REFLECTOR CLEANED EVERY TIME SWITCH IS PULLED

lamps and is sent out completely wired and assembled so that any maintenance man may erect the unit on existing outlets.

Single and Multiple CO_2 Indicator

The Uehling Instrument Company, 71 Broadway, New York City, is offering a new design in single and multiple forms of CO_2 equipment, the latter serving any number of steam boilers simultaneously up to a total of six. Among the manufacturer's claims are speedy action, resulting from a new



SCHEME OF OPERATION OF CO_2 INDICATOR

form of aspirator, absence of chemical solutions, simplicity and a plan for providing an auxiliary boiler-front CO_2 indicator.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

STEVENS, WALLIS & BRAZIER, INC., Deseret Bank Building, Salt Lake City, factory representatives of electrical manufacturers and advertising directors for jobbers, are handling the advertising of the Automatic Electric Washer Company in eleven Western states. This firm was responsible for the effective advertising whereby 1,711 automatic washing machines were sold during the month of March in the Intermountain territory by the Utah Power & Light Company. This is the record for retail sales on washing machines in this territory. Mr. Brazier, the manager of the selling department, was formerly sales manager for a number of years for one of the largest electrical jobbing houses in the West. Mr. Stevens, the president of the company, was for years connected with the electrical industry in both the merchandising and the power-production fields.

THE HOLTZER CABOT ELECTRIC COMPANY, Roxbury, Mass., is planning to erect an addition to its plant, 26 ft. x 78 ft.

J. A. JANNEY, central district specialist on household appliances for the Western Electric Company, will become field sales manager for the National Sweeper Division of the Torrington Company, Torrington, Conn., on Sept. 1.

COL. EDWARD B. ELLICOTT, recently mustered out of the army after two and one-half years' service in the chemical warfare division, is associated with A. M. Castle & Company, Chicago, as chief engineer. Previous to entering the service he was for eight years city electrician of Chicago and for eleven years chief electrical engineer of the Sanitary District of Chicago.

RALPH B. COLEMAN, well known among Middle Western central-station men, has become associated with the Consolidated Wire and Machinery Corporation, 519-529 West Van Buren Street, Chicago.

THE CHASE-SHAWMUT COMPANY Newburyport, Mass., has taken over the Chase-Shawmut Department of the Condit Electrical Manufacturing Company, with Sears B. Condit, Jr., president and treasurer, and Frank D. Masterson, vice-president and general manager. Mr. Masterson has been associated with the Shawmut fuse business for twenty-one years.

THE GRANDEN ELECTRIC COMPANY has been organized to take over the property and business of the Burgess-Granden Company, Omaha, Neb., Mr. Burgess of the latter company having retired from business. The company will continue to manufacture artistic lighting fixtures and to deal in electrical appliances and supplies. Charles A. Granden, formerly secretary and treasurer of the Burgess-Granden Electric Company, is president of the new company.

THE WESTERN REFLECTOR COMPANY has removed its plant from 1053 West Lake Street, to 1221 West Madison Street, Chicago, where it has much larger quarters.

LANDERS, FRARY & CLARK, INC., New Britain, Conn., has leased the large portion of the plant now held by the Tuskeloid Company at Sussex Avenue and Dey Street, Newark, N. J., which it will equip at once for the manufacture of metal kitchen products.

THE GREENFIELD TAP & DIE CORPORATION, Greenfield, Mass., has completed plans for enlarging its forge shop at Turners Falls, consisting of two new buildings, on which work will be started at once. The proposed new five-story plant of the company at Greenfield is held up for the time being.

THE SENECA WIRE & IRON COMPANY, Fostoria, Ohio, has filed plans for an addition, 167 ft. x 208 ft., to cost with equipment about $100,000.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has awarded contract for the erection of a one-story addition to its plant at Essington, 120 ft. x 200 ft., to be used as a foundry.

THE BLACK & DECKER MANUFACTURING COMPANY, Towson Heights, Baltimore, Md., has increased its capital stock from $350,000 to $2,000,000.

THE GLACIER MACHINE MANUFACTURING COMPANY, Chicago, manufacturer of ice-making machines, has leased a plant at Ravenswood, Schreiber, Devon and Hermitage Avenues.

THE ADVANCE ELECTRIC COMPANY, 6315 Maple Avenue, St. Louis, manufacturer of electrical devices, has filed plans for the erection of a one-story extension, 50 ft. x 100 ft., to cost about 15,000.

THE HIGH POINT MACHINE WORKS, High Point, N. C., dealer in used equipment, announces that Lee Overman has taken charge of its electrical department, his appointment having taken effect Aug. 15. The department has been enlarged and a force of experts added.

THE EXPORT MANAGERS' CLUB of Bridgeport, Conn., was organized on July 1. It consists of the export managers of twenty-one of the large manufacturers in Bridgeport, and for the present the number of active members is limited to twenty-five. As many associate members will be admitted as it is found possible to accommodate at the meetings. Robert M. Eames, export manager of the Bryant Electric Company, is president; John J. Conway, export manager of the Acme Shear Company, is vice-president, and Harold W. French, export manager of the Bridgeport Hardware Manufacturing Corporation, is secretary and treasurer.

THE HIRCHY COMPANY, manufacturer of clothes-washing machines, formerly located in the Security Building, Minneapolis, Minn., is now established at 257-263 South First Avenue, East, Duluth, Minn.

THE NATIONAL LAMP WORKS, Cleveland Ohio, is holding its eighth consecutive summer sales conference for its field executives and jobber representatives at its camp adjoining the Nela Park works of the company. Each week from June until September the conference is in session, and gives lectures, demonstrations and factory trips. Various kinds of games and recreational features are also incorporated in the programs.

THE UEHLING INSTRUMENT COMPANY, 71 Broadway, New York City, manufacturer of fuel economy equipment, announces that it is now represented in New England States by the Smith Engineering & Supply Company, 89 State Street, Boston, Mass., manufacturers' agents and engineers, specializing in power-plant equipment. S. W. Smith, president of the latter company, was until recently associated with the Uehling Instrument Company, with headquarters in the New York office.

THE M. B. AUSTIN COMPANY, 700 West Jackson Boulevard, Chicago, manufacturer of electrical supplies, has acquired a site at 108-116 South Desplaines Street, 91 ft. x 118 ft., on which it proposes to erect a two-story plant, to cost about $100,000.

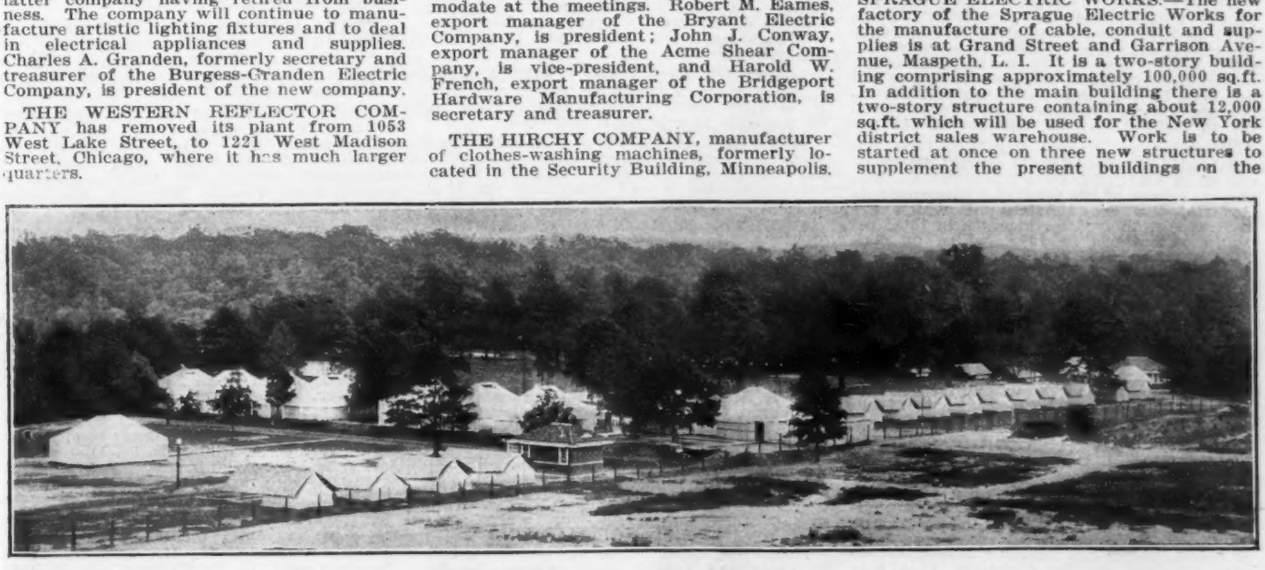
RICKARD & SLOAN, INC., New York City, announce the removal of their offices from the Evening Post Building to 25 Spruce Street, effective Aug. 1, where they will have much larger quarters.

THE CRANE COMPANY, 836 South Michigan Avenue, Chicago, recently celebrated the sixty-fifth anniversary of the founding of the company by R. T. Crane in 1855. Today the company has three main groups of buildings devoted to manufacturing in Chicago, Ill., Bridgeport, Conn., and Montreal, Canada, having a total working space of 13,856,042 sq.ft., and its employees number 15,304. From the factories its products go into fifty-nine branches and warehouses of the company. In this catalog are listed 20,000 different articles covering "Everything for Any Pipe Line Anywhere." It is interesting to note the long-continued co-operation of the 518 directing and executive heads of the Crane organization, their service averaging twenty and a half years. The Crane coworkers hold $7,000,000 of the Crane Company preferred stock, and stockholders may be found in every part of the organization.

THE MEADOWS MANUFACTURING COMPANY, formerly of Pontiac, Ill., is now established in its new factory at Bloomington, Ill. The company manufactures power washing machines, grain elevators, etc.

THE WAITE & BARTLET MANUFACTURING COMPANY, manufacturer of electrotherapeutic apparatus, has moved its plant from New York City to 53 Jackson Avenue, Long Island City, N. Y., where general offices, factory and salesrooms will be located. Dental X-ray rooms have been opened at 103 Park Avenue, New York City.

MASPETH FACTORY OF THE SPRAGUE ELECTRIC WORKS.—The new factory of the Sprague Electric Works for the manufacture of cable, conduit and supplies is at Grand Street and Garrison Avenue, Maspeth, L. I. It is a two-story building comprising approximately 100,000 sq.ft. In addition to the main building there is a two-story structure containing about 12,000 sq.ft. which will be used for the New York district sales warehouse. Work is to be started at once on three new structures to supplement the present buildings on the



CAMP NELA SALES CONFERENCE

property, including a warehouse containing about 19,000 sq.ft., a garage about 120 ft. x 25 ft., and a small warehouse 100 ft. x 15 ft. for the storage of rigid conduit. It is expected to have these buildings ready for occupancy within sixty days.

J. J. COSTELLO, formerly sales engineer with James C. Barr, Boston, has established offices at 201 Devonshire Street, that city, where he will represent the Lewis & Roth Corporation, Philadelphia, manufacturer of high-tension devices and power-plant specialties and also will handle the New England sales for the Cutter Company, Philadelphia, manufacturer of the I-T-E line of circuit breakers and other equipment.

SPECIAL COURSE FOR TECHNICAL MEN.—Arrangements have been completed by the educational authorities of the Western Electric Company, 195 Broadway, New York City, and the faculty of Columbia University to enable the employees of the former to carry on post-graduate courses coincident with their regular duties. This system has been limited to the members of the engineering department, where more than 3,000 technical students are eligible to take advantage of the offer. Approved graduates of colleges and scientific schools may pursue graduate work for masters' degrees and fulfill the requirements in two calendar years.

Supply Jobbers' Notes

THE MILNER-FLOWER COMPANY, Buffalo, N. Y., has moved from its old location and is now occupying the entire building at 9 Union Terrace, which has been remodeled to accommodate its electrical appliance jobbing business.

Foreign Trade Notes

ELECTRICAL TRADES DIRECTORY.—"The *Electrician* Directory and Hand Book of the Electrical Engineering and Allied Trades" (the blue book) for 1920, has been issued by Benn Brothers, Ltd.; *Electrician* offices, 8 Bouverie Street, E. C. 4, London, England.

GREAT DEMAND FOR ELECTRICAL SERVICE IN PARIS.—At the present time a large number of electrical installations are being made in Paris. This, it is understood, is being done by the tenants at their own expense, they having waited in vain for prices to fall and now fearing a further increase in cost. The present charge for the installation is estimated at about 3,000 francs for three rooms, about four times pre-war costs.

GREAT INCREASE IN USE OF ELECTRICITY FOR DOMESTIC AND INDUSTRIAL PURPOSES IN NORWAY.—From 1910 to 1918 the consumption of electricity for industrial purposes in Norway increased from 145,000 hp. to 770,000 hp., increasing at the rate of 80,000 hp. per annum, or 430 per cent in all. Domestic requirements increased during the same period from 68,000 hp. to 210,000 hp., an increase of 210 per cent.

LARGE INCREASE IN CONSUMPTION OF ELECTRICITY IN ARGENTINA.—The annual report of the Société d'Electricité de Rosario, the headquarters of which are in Brussels, showed an increase in total receipts over those in 1918, while, as contrasted with 1915, the advance is no less than 50 per cent. The supply of electricity to private houses is now 80 per cent greater than in 1915. The report refers to the rapid way in which domestic electrical appliances, notably electric flatirons, are being adopted, these being now used even in the most modest household. The consumption of energy for power purposes increased 33 per cent in the last year. Altogether the company is now funishing service to 21,630 consumers, as against 1,284 in 1915.

WATER POWER in GREEK MACEDONIA.—By a law recently passed the Greek government is authorized to expropriate, with safeguards for the protection of private interests, water power of a number of rivers and waterfalls in Macedonia, which it is estimated would develop a total of about 66,000 hp. Recent investigations have resulted in the discovery that new sources of water power, capable of developing from 20,000 hp. to 30,000 hp., might be created by the junction of several rivers. Practically all of the larger falls in Macedonia are on the railway lines between Monastir and Saloniki. At present less than one-tenth of the total available power is being utilized.

Trade Publications

POWER WASHERS. — The Meadows Manufacturing Company, Pontiac, Ill., is distributing a sixteen-page booklet describing its different types of "Meadows" power washing machines.

BATTERIES. — The O-K Giant Battery Corporation, Gary, Ind., is distributing a seventy-two page booklet entitled "Face to Face with Facts," in which it describes its various types of dry rechargeable batteries.

GAGES.—The Schaeffer & Budenberg Manufacturing Company, Brooklyn, N. Y., has issued catalog sections No. 1, 50 and 75, covering its pressure, vacuum and draft, gages and gage testers; also a preliminary bulletin describing its hand and stationary tachometers.

POWER-PLANT DEVICES. — The Yarnell-Waring Company, Chestnut Hill, Philadelphia, Pa., has issued folder No. G 1301, covering the Yarway devices for modern power plants, and booklet No. B 410, describing different types of the Yarway blow-off valves.

INSTRUMENTS.—"A Few Simple Methods of D. C. Testing in Routine Practice" is the subject of bulletin No. 13, recently published by the Pyroelectric Instrument Company, 636 East State Street, Trenton, N. J.

FUSES. — E. W. Snow & Company, Rochester, N. Y., are circulating catalog No. 15, covering their different types of inclosed electric fuses.

HYDRO-ELECTRIC PLANTS.—"Hydro-Electric Developments" is the title of an illustrated booklet published by Charles T. Main, engineer, 201 Devonshire Street, Boston, describing a number of hydro-electric developments. Several photographic reproductions of different plants are also shown.

ICE-MAKING APPARATUS.—The Frick Company, Waynesboro, Pa., is distributing three numbers of "Ice and Frost," series A, covering its ice-manufacturing machinery as follows: No. 3, describing its inclosed compressors; No. 4, small refrigerating plants, and No. 5, vertical and horizontal refrigerating machines.

PIPE AND TANKS.—The Redwood Manufacturers' Company, Hobart Building, San Francisco, Cal., has issued catalog 9, describing its Remco redwood pipe, and price list 14, covering its Remco redwood tanks.

LIGHTING SYSTEMS.—The National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, is distributing a folder entitled "Eye Comfort," inclosing leaflets describing its apparatus for industrial-lighting, store-lighting and flood-lighting systems.

MERCURY-ARC RECTIFIERS. — The General Electric Company, Schenectady, N. Y., is distributing a small booklet covering its multiple mercury-arc rectifiers.

MELTING POTS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a two-page leaflet, entitled "Metal Melting Pots," describing the C-H melting pots, both portable and bench types.

DEVICES FOR CONDUIT CONNECTIONS.—"Spraguelets" is the title of a small booklet issued by the Sprague Electric Works of the General Electric Company, New York City, covering its Spraguelet devices for conduit connections. The company is also distributing a booklet entitled "The Universal Key," "a cross-reference for matching any standard wiring device to any desired box and cover."

RIVETED STEEL PIPE.—The Western Pipe & Steel Company, of California, San Francisco, Cal., is distributing bulletin A-19, describing its riveted steel pipe and accessories.

PANELBOARDS, SWITCHES, ETC.—Bulletins Nos. 1, 3, 4, 6, 7, 8 and 13, issued by the Metropolitan Electric Manufacturing Company, Boulevard and Fourteenth Street, Long Island City, N. Y., describe and illustrate respectively its standard panelboards, steel boxes and trims, safety panelboards, rotary snap-switch panels, standard knife switches, inclosed fuses, "Yankee" renewable fuses, plug fuses and flush switches, etc.

WATERWHEEL-DRIVEN GENERATORS.—Bulletin No. 40,601, entitled "Vertical Shaft Waterwheel-Driven Generators," published by the General Electric Company, Schenectady, N. Y., describes and illustrates its standard vertical waterwheel-driven generators from 30 kva. to 625 kva.

BATTERY-CHARGING SETS. — The General Electric Company, Schenectady, N. Y., has recently issued bulletin No. Y-1364, covering its multiple-battery-charging motor-generator sets, and bulletin No. Y-1369, describing its motor-generator sets for series-multiple charging; also bulletin No. 64,200, describing and illustrating its new gathering locomotive, trolley type.

GASOLINE MOTORS FOR STATIONARY WORK.—The Sterling Engine Company, Buffalo, N. Y., has issued a twenty-four page booklet with illustrations covering the Sterling gasoline motors for stationary work for driving centrifugal pumps and electric generators.

WATERWHEELS.—Bulletin No. 40 issued by the Fitz Water Wheel Company, Hanover, Pa., describes and illustrates its "I-X-L" steel overshot waterwheels and accessories.

FEED-WATER HEATERS. — Warren, Webster & Company, Camden, N. J., have issued bulletins No. 100-1 and 102, covering the "Webster" feed-water heaters, rectangular cast-iron types.

New Incorporations

THE FULTON COUNTY GAS & ELECTRIC COMPANY, Gloversville, N. Y., has been incorporated with a capital stock of $1,732,600. The company is a consolidation of the Fulton County Gas & Electric Company and the Mohawk Electric Company and will operate in the counties of Fulton, Herkimer, Montgomery, Otsego, Schenectady and Schoharie. Among the directors are Lucius H. Liiteaur, New York City; Walter Clark, Philadelphia, and James C. Delong, Syracuse, N. Y.

THE RARITAN VALLEY HYDRO-ELECTRIC COMPANY, Three Bridges, N. J., has been incorporated with a capital stock of $100,000 by I. F. Halton, Brooklyn, N. Y.; C. W. Alspaugh, Bernardsville, and J. S. Ammermann, Neshanic, N. J.

THE ROSSIE (N. Y.) ELECTRIC & MANUFACTURING CORPORATION has been incorporated with a capital stock of $50,000, by Dr. T. A. E. Young, John W. Wilson, George N. Wilson of Rossie; Alvin Nebon and John Williamson, South Hammond. The company proposes to develop water power and plants for generating and transmitting electricity.

THE LOWE-ELLIOTT CORPORATION, Freeport, N. Y., has been chartered with a capital stock of $50,000 to manufacture electric storage batteries and kindred products. The incorporators are H. M. Lowe, W. J. Martin and M. A. Elliott.

THE ANTHRACITE ELECTRIC & WELDING COMPANY, Pottsville, Pa., has been incorporated with a capital stock of $20,000 to manufacture electric welding equipment. Martin L. Dunn is treasurer.

THE SOONER BATTERY & ELECTRIC COMPANY, Okmulgee, Okla., has been incorporated by B. C. Campbell, Lee W. Cotter and O. J. Hannigan. The company is capitalized at $10,000 and proposes to manufacture electric batteries and other electrical apparatus.

THE FLAT ROCK LIGHT & POWER COMPANY, Anderson, S. C., has been incorporated with a capital stock of $5,000 by W. L. Hayes, J. Wesley Brown and L. C. Keys.

THE OAK RIDGE (N. C.) LIGHT & POWER COMPANY has been organized to distribute electricity to be furnished by the Southern Power Company. D. L. Donnell is president and D. L. Nance secretary and treasurer.

THE LEWISBURG (KY.) ELECTRIC LIGHTING COMPANY has been incorporated by O. A. Bland, E. W. Duncan and James Westry. The company is capitalized at $10 000 and proposes to operate an electric light and power system in Lewisburg.

THE CASE ELECTRIC COMPANY, Fairmont, W. Va., has been incorporated by E. L. Lively, W. H. Spedden, T. M. Courtney and F. K. Everett, all of Fairmont. The company is capitalized at $10,000 and proposes to do a general electrical engineering and contracting business.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

NASHUA, N. H.—Plans are under way by the Nashua Manufacturing Company for extensions and improvements to its power house.

CHARLESTOWN, MASS.—The Palmer & Parker Company, 103 Medford Street, contemplates the construction of a power house at its factory to cost about $15,000.

TAUNTON, MASS. — The Municipal Lighting Commission has awarded contract to the Westinghouse Electric Company, 6905 Susquehanna Street, Pittsburgh, Pa., for additions and extensive improvements to the municipal electric light plant on West Water Street to cost about $400,000.

WAKEFIELD, MASS.—The Heyward Brothers & Wakefield Company are not contemplating the erection of a power house as was erroneously stated in these columns Aug. 7.

PAWTUCKET, R. I.—The American Electrical Works of Phillipsdale has plans under way for the erection of a transformer station, 15 ft. x 40 ft., at its plant.

PAWTUCKET, R. I.—Contract has been awarded to Joseph F. Cole, Niagara Street, Providence, by the What Cheer Chemical Company for the erection of a power house at its plant to cost about $45,000.

BRIDGEPORT, CONN.—Bids are being received by Fletcher & Thompson, Inc., engineers, 1089 Broad Street, for an addition to the power house of the Bridgeport Brass Company, East Main Street, to cost about $14,000.

HARTFORD, CONN.—Bids will be received by the Board of Education until Sept. 7 for the erection of a high school to cost about $750,000. Electric lighting equipment will be installed. Whiton & McMahon, 36 Pearl Street, are architects.

MONTVILLE, CONN. — Contract has been awarded to the Austin Company, 217 Broadway, New York, N. Y., by Robert Gair & Company, 50 Washington Street, Brooklyn, N. Y., for the erection of a paper factory and power house to cost about $600,000, at Montville. William Higginson, 18 East Forty-first Street, New York, N. Y., is architect.

NEW BRITAIN, CONN.—The Board of Education will soon award contract for the construction of a school to cost about $350,000. An electric lighting system will be installed. D. K. Perry, 27 West Main Street, is architect.

NEW HAVEN, CONN.—A petition has been circulated among the merchants of Dixwell Avenue for the installation of an ornamental street lighting system on that thoroughfare from Broadway to Shelton Avenue.

WINDSOR LOCKS, CONN.—The Connecticut River Company, care of C. H. Tenney & Company, 201 Devonshire Street, Boston, Mass., contemplates the erection of a dam 30 ft. high and 2,000 ft. long, on the Connecticut River for power purposes.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the superintendent of school buildings of the Board of Education, Room 2800, Municipal Building, Manhattan, until Sept. 1, for installing electric light equipment in public schools 10, 23, 35, 45, 53 and 77, Brooklyn.

HORNELL, N. Y.—Application has been made to the Public Service Commission by the Hornell Electric Company for permission to erect a power plant at Hornellsville, with local distribution system for light and power service.

MIDDLETOWN, N. Y.—A charter has been granted to the Oakland Power Company to generate electricity for light, heat and power purposes in Orange and Sullivan Counties.

OSSINING, N. Y.—Bids will be received by Charles F. Rattigan, superintendent of State Prisons, Capitol, Albany, until Sept. 15, for the construction of a building for additional accommodations, electrical work, addition to the power house, etc., at Sing Sing Prison, Ossining.

CROSSWICKS, N. J. — Charles W. Bricks plans to erect a power and lighting plant at Crosswicks for the purpose of supplying electrical energy to residents of that place and to North Crosswicks. Application has been made to the Board of Freeholders for permission to erect overhead wires and underground equipment in North Crosswicks.

ELIZABETH, N. J.—The Board of Education has plans under way for the construction of a new power house in connection with an addition to the local high school on South Street. Total cost is estimated at about $350,000.

NEWARK, N. J.—The Board of Trade, 800 Broad Street, will soon receive bids for the erection of an office building to cost about $1,000,000. Electric light equipment will be installed. Guilbert & Betelle, 2 Lombardi Street, are architects.

THREE BRIDGES, N. J.—The Raritan Valley Hydraulic Electric Company contemplates the erection of an electric power plant near Three Bridges. C. W. Alpaugh of Bernardsville is head of the company.

WEEHAWKEN, N. J.—The Board of Education has received a bid on electrical work for the new Public School No. 1, West New York, from Walter Coleman, Jersey City, at $13,633.

DILLSBURG, PA.—Notice has been filed by the Dillsburg Light, Heat & Power Company of an increase of $40,000 in capital stock for proposed expansion.

EASTON, PA. — Contract has been awarded to Wark & Company, 1239 South Broad Street, Philadelphia, by the Young Men's Christian Association, 9 Centre Square, Easton, for the erection of a Y. M. C. A. building to cost about $400,000. Electric lighting equipment will be installed.

HARRISBURG, PA.—A special meeting of stockholders of the Harrisburg Light & Power Company will be held on Sept. 24 for the approval of an increase in capital stock of $1,720,000, part of which will be used for extensions and improvements to its electric plant and system.

NEW CASTLE, PA.—The Lehigh Portland Cement Company, 718 Hamilton Street, Allentown, has plans under way for the construction of several buildings at New Castle to cost about $200,000, including a waste heat installation power house, 44 ft. x 140 ft.

PHILADELPHIA, PA.—The Philadelphia Roll & Machine Company, Twenty-fifth Street and Washington Avenue, contemplates the erection of a power plant at Fifty-second Street and Grays Avenue.

SHINNSTON, W. VA.—The Ridge Silk Company of Clarksburg contemplates the erection, by day labor, of buildings at Shinnston to cost about $30,000, including an electric power plant to cost $6,000. J. H. Nuzum is president.

HAMPTON ROADS, VA.—Contract has been awarded to John R. Proctor, 74 Cortlandt Street, New York, N. Y., by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of an underground electric distribution system on Block Z, at $34,880.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 3 for furnishing arc radio transmission equipment for the navy yard at Philadelphia, Pa. (Specification 6,148.)

North Central States

CARSON CITY, MICH.—Plans are under way for the erection of a power plant in Carson City to cost about $150,000. The Fargo Engineering Company, Jackson, are engineers. Work will be done by day labor.

DETROIT, MICH.—Bids will be received by the Public Lighting Commission, Atwater Street, for furnishing the following materials, freight prepaid, to Detroit: 3,000 ft. No. 6 B. & S. G. solid copper wire, 8-32-in. varnished-cambric insulation, covered by asbestos braid; 30,000 ft. No. 6 B. & S. copper wire, stranded 4-32 in. 30 per cent Para rubber insulation, double-braid, 3,000 ft. No. 6 B. & S. G. stranded copper wire 8-32-in. 30 per cent Para rubber insulation, double braid; 4,000 ft. No. 10 B. & S. G. strand copper wire, 2-32-in. 30 per cent Para insulation, double braid; hard-drawn copper wire, triple-braid weatherproof insulation as follows: 5,000 lb. No. 2, 2,000 lb. No. 4 and 30,000 lb. No. 6 B. S. & G. solid conductor, 1,500 lb. No. 4 B. & S. G. stranded conductor, 500 lb. No. 10 B. & S. solid conductor; soft-drawn copper wire, double-braid waterproof insulation as follows: 3,000 lb. No. 6 B. & S. G. stranded conductor, 5,000 lb. No. 12 B. & S. G. solid conductor. G. J. Finn is commissioner of purchases and supplies.

MARION, MICH.—The Winterfield Light & Power Company, recently organized at Marion, contemplates the erection of a power plant near Everett for furnishing light and power to several towns.

SAGINAW, MICH.—The American Safety Navigation Company, care of managing secretary, Board of Commerce, has plans under way for the construction of a factory and an office building, the initial units of plant to cost about $10,000,000. Electric light and power equipment will be installed.

COLUMBUS, OHIO.—Contract has been awarded to E. J. Spencer, Huntington Bank Building, by the Columbus Railway, Power & Light Company, 102 North Third Street, for the erection of a substation to cost about $25,000.

GREENVILLE, OHIO.—Plans are under way for the erection of a power plant, 35 ft. x 40 ft., for the Franklin Traction Company, George Hill president and manager, Eighth and Broadway Streets.

RUDOLPH, OHIO—The Rudolph Light & Power Company, recently incorporated with a capital stock of $10,000, contemplates the erection and operation of an electric light plant.

TOLEDO, OHIO.—H. J. Ricker, 343 Spitzer Building, contemplates the purchase of five 50-hp., 220-volt, 60-cycle, three-phase motors and on electrically driven centrifugal pump not under 3-in. to 4-in. intake, complete with starting compensator.

HENDERSON, KY.—The city officials contemplate the purchase of electric light poles to cost about $2,000.

PRINCETON, ILL.—The installation of an additional unit in the municipal electric light plant, to develop 400 hp., is contemplated at a cost of about $17,000.

SPRINGFIELD, ILL.—The construction of a lighting system on Fourth Street is under consideration.

TAYLORVILLE, ILL.—Bids will be received about Oct. 1 for the proposed addition to the municipal pumping station which will convert it into a combination light plant and pumping station. Plans include the installation of two 300-kw. generating units and one of 200-kw., two 300-kw. boilers, switchboards, etc. Improvements will also be made to the street-lighting system. W. S. Merkle, Laclede Gas Light Building, St. Louis, Mo., is consulting engineer.

BRUCE, WIS.—Extension of the power and light line of the Big Falls Power Company from Bruce to Apollonia is contemplated.

MANCHESTER, IOWA.—Survey of the municipal pumping station is being made by W. E. Skinner, engineer, 15 South Fifth Street, Minneapolis, Minn., with a view of electrifying the equipment. It is probable that a survey of the municipal power plant may be made later.

BUTLER, MO.—Bonds to the amount of $65,000 have been voted for the erection of an electric power plant. J. F. Smith is city clerk.

KANSAS CITY, MO.—Extension of the ornamental street-lighting system on Thirty-first Street from the Paseo to Prospect Avenue is under consideration.

ST. JOSEPH, MO.—Bids will be received about the middle of September by the Western Tablet Company, Eleventh and Mitchell Streets, for the erection of a power house to cost about $35,000. R. & E. R. Meier, 203 Lincoln Building, are architects.

ELLENDALE, N. D.—The Ellendale Electric Company contemplates the erection of an electric transmission line from Ellendale to Guelph and Ludden, to cost about $25,000. G. E. Phillips is manager.

Southern States

PAYNE CITY, GA.—Improvements and extensions to the electric lighting system are contemplated by the City Council.

MIAMI, FLA. — The Bay View Estate Corporation will erect an electric light and power plant.

CLARKSVILLE, TENN.—The Kentucky Public Service Company contemplates the purchase of electric equipment, turbines, etc., in connection with the local electric light plant now being rebuilt.

KNOXVILLE TENN.—The Knoxville Railway & Light Company contemplates extensive improvements to its power plant and transmission systems.

FLORENCE, ALA.—Contract has been awarded to the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., at $779,400 for four generators and accessories to be used in connection with the Wilson Dam.

PINE BLUFF, ARK.—The Jefferson Cotton Oil Mill Company contemplates the installation of thirteen additional motors to complete electrification of its mill.

SHREVEPORT, LA.—At an election to be held on Sept. 14 a proposal to issue $25,000 in bonds for the construction of a fire-alarm system will be submitted to the voters.

McALESTER, OKLA.—The Abbott Pike Lodge has plans under way for the construction of a Masonic Temple to cost about $500,000. Thompson & Harding, 504 Southern Trust Building, Little Rock, Ark., are architects.

AMARILLO, TEX.—At an election to be held soon a proposal to issue $426,000 in bonds for municipal improvements, including $30,000 for a fire alarm station, will be submitted to the voters.

CLEBURNE, TEX. — The local waterworks contemplates the installation of a 150-hp. electric motor and a compressor with daily capacity of 1,250,000 gal. W. S. Hockaday is superintendent.

DALLAS, TEX. — The Texas Hosiery Mills, 1407-09 South Ervay Street, will establish a hosiery factory and contemplates the installation of electrically-driven knitting machinery.

WICHITA FALLS, TEX.—Bids will be received by the Chamber of Commerce until Sept. 1 for the installation of a lighting system on ten streets in the city. Plans include laying 30,245 ft. cable, constructing 324 concrete bases and erecting standards

Pacific and Mountain States

TACOMA, WASH.—The Consumers' Central Heating Company contemplates the erection of a power and heating plant to cost about $200,000 and the installation of electrical machinery to generate 1,600 hp.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., and at the Public Works Office, Navy Yard, Mare Island, Cal., until Sept. 11 (Specification 4127), for a lighting protection system in connection with the ordnance buildings to be erected at Mare Island. A deposit of $10 is required for plans and specifications, which may be obtained at the above address and from the Commandant, Navy Yard, Mare Island.

OGDEN, UTAH.—Bids will be received at the office of the contracting quartermaster, 317 Colonel Hudson Building, for the construction of sixty buildings, electrical work, etc., near Ogden. Plans and specifications and further information may be obtained on application to the above address.

EMIGRANT, MONT.—According to a decision of the game and fish commission at Helena, improvements are to be made to the Emigrant fish hatchery, including the erection of an electric light plant, garage, etc.

LOVELAND, COL. — Petition has been made to the State Public Utilities Commission for permission to continue the construction of a municipal power and light plant.

Canada

ST. JOHN, N. B.—The New York Cotton Mills contemplates electrification of its plant.

FORD CITY, ONT. — The Fisher Body Company of Canada contemplates the erection of a factory for the manufacture of auto bodies. Electric light and power equipment will be installed. Albert Kahn, Walker Road, Walkerville, is architect.

PORT ARTHUR, ONT.—The Kaministiquia Pulp & Paper Company contemplates the installation of a hydro-electric plant at its new pulp mill. The cost is estimated at about $1,000,000.

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 10, 1920)

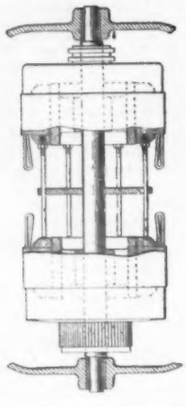
1,349,358. SHAFT BRACING; David Barclay, Conneautville, and Adolphus M. Dudley, Oakmont, Pa. App. filed Sept. 10, 1915. Truss between motor and generator of combined sets.

1,349,365. SYSTEM OF DISTRIBUTION FOR RAILWAY FEEDER CIRCUITS; Almon W. Copley, Wilkinsburg, Pa. App. filed March 8, 1917. Reverse-energy relay.

1,349,371. ELECTRICAL SYSTEM; Siegmund H. Eckmann, Manchester, England. App. filed July 14, 1915. Combination of direct-current generators for load control.

1,349,373. MEASURED-SERVICE TELEPHONE SYSTEM; John Erickson, Chicago, Ill. App. filed Dec. 15, 1916. Pay station for automatic phones.

1,349,375. SYSTEM OF CONTROL; Arthur J. Hall, Wilkinsburg, Pa. App. filed July 5, 1917. For polyphase machines operated through phase converters.



1,349,358. Shaft Bracing

1,349,376. CONTROL SYSTEM; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 5, 1916. To prevent slippage of induction-motor-driven vehicles.

1,349,377. DYNAMO-ELECTRIC MACHINE; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 7, 1916. Arrangement of windings.

1,349,379. CONTROL SYSTEM FOR ELECTRIC FURNACES; Edgar A. Hester, Edgewood Park, Pa. App. filed Oct. 30, 1918. Changes transformer taps.

1,349,381. AUTOMATIC TELEPHONE SYSTEM; Emil Jacobsen, Chicago, Ill. App. filed March 25, 1918. For releasing connector switches.

1,349,385. ELECTRICAL PROTECTIVE DEVICE; Herbert Pearce, Manchester, England. App. filed May 2, 1918. For parallel feeders.

1,349,501. MAGNETIC SEPARATOR; Myron Dings, Milwaukee, Wis. App. filed Aug. 2, 1918. Circular cross-conveyor with plurality of unloading points.

1,349,531. AUTOMATIC FIRE ALARM; George B. Rattermann, Chicago, Ill. App. filed Nov. 5, 1917. Phonographic record attachment calls alarm over telephone lines.

1,349,539. PORTABLE ELECTRIC RIVET HEATER; Louie T. Weidrick, Baltimore, Md. App. filed April 6, 1920. Arc furnace.

1,349,548. RAILROAD ELECTRIC LANTERN; Harold C. Breckenbridge, Musselshell, Mont. App. filed Aug. 16, 1919. Displays differently colored lamps.

1,349,549. ELECTROPLATING APPARATUS; William Dietzel, Merrick, N. Y. App. filed Feb. 18, 1919. Rotary.

(Issued Aug. 17, 1920)

14,929 (reissue). DRY BATTERY; Ferdinand P. Baumann, Kusnacht, Switzerland. App. filed May 28, 1918. Electrodes in the form of plates.

1,349,583. FRAME FOR LAMP RESISTANCES; Harry D. Rohman, New York, N. Y. App. filed March 20, 1917. Installed in connection with standard panelboards for lighting and heating systems.

1,349,584. REVERSING BRUSH GEAR FOR DYNAMO-ELECTRIC MACHINES; Harry D. Rohman, New York, N. Y. App. filed Oct. 9, 1917. Maintains constant polarity in the external circuit regardless of the direction of rotation.

1,349,597. ELECTROLYTIC CELL; Herbert I. Allen and Kent R. Fox, Portland Me. App. filed April 2, 1919. Cathode in shape of a rectangular box.

1,349,655. ELECTRICAL TESTING DEVICE; Richard C. Bierbower, San Antonio, Tex. App. filed June 11, 1918. Improved mechanical interrupter.

1,349,656. ELECTRICAL TESTING DEVICE; Richard C. Bierbower, San Antonio, Tex. App. filed Oct. 2, 1919. Spark coil for high-tension testing.

1,349,678. ELECTRIC SEWING-MACHINE CABINET; Emil A. Kopf, Newark, N. J. App. filed Sept. 14, 1917. When folded appears as table.

1,349,692. MAGNETO FRAME; Pierre J. R. Postel-Vinay, Paris, France. App. filed Oct. 13, 1919. Improved lid over brushes.

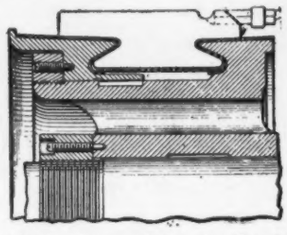
1,349,729. MODULATING AND TRANSMITTING SYSTEM; Edward L. Nelson, East Orange, N. J. App. filed March 8, 1918. Coupling oscillating audions or similar electric discharge devices in a new manner.

1,349,792. CONDENSER; Ralph W. Stearns, Schenectady, N. Y. App. filed Oct. 24, 1916. For absorbing high-frequency disturbances on distribution systems.

1,349,831. TESTING APPARATUS; Walter W. Gramer, Marinette, Wis. App. filed March 8, 1919. For testing spark plugs.

1,349,854. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; Edward D. Priest, Schenectady, N. Y. App. filed Dec. 17, 1917. Reduces vibration of leads and provides means whereby machine will be operative even though one lead breaks.

1,349,866. ENGINE-STARTING APPARATUS; Lionel M. Wolffsohn, Union, N. J. App. filed March 8, 1917. Clutch device for automobile starter.



1,349,854. Commutator for Dynamo-Electric Machines

1,349,870. ELECTRICAL STARTING APPARATUS; Joseph Bijur, New York, N. Y. App. filed Nov. 21, 1914. Starter disengages when engine starts.

1,349,892. METHOD OF AND MEANS FOR OBTAINING CONSTANT DIRECT CURRENTS OR POTENTIALS; Irving Langmuir, Schenectady, N. Y. App. filed Dec. 22, 1915. Kenetron rectifier producing current of high degree of constancy.

1,349,904. ALARM DEVICE; Wilmer W. Miller, Ardmore, Pa. App. filed Aug. 4, 1916. Burglar alarm sent over telephone circuits.

1,349,907. APPARATUS FOR RECTIFYING ELECTRIC CURRENTS; Arthur F. Nesbit, Wilkinsburg, Pa. App. filed Aug. 20, 1914. Employs spark gap in combination with condensers.

1,349,957. BATTERY-TERMINAL FASTENING; Alda F. Hawkins, Fort Worth, Tex. App. filed April 5, 1920. Clamped terminal for storage cells.

1,349,961. SIGNALING SYSTEM; Richard M. Hopkins, New York, N. Y. App. filed Oct. 20, 1916. Fire-alarm system which avoids continued operation of alarm due to trouble in transmitter.